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A County Level Analysis of 2014 Farm Bill Commodity Payments

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AN INDIANA COUNTY LEVEL ANALYSIS OF 2014 FARM BILL COMMODITY PAYMENTS

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ABSTRACT

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United States commodity policy was subject to a large transition in how the federal government supports agricultural producers when the 2014 Farm Bill was passed in February of 2014. The new programs are the Agricultural Risk Coverage (ARC) and the Price Loss Coverage (PLC) programs. Methods used by the federal government to distribute farm income support have evolved from constant decoupled payments into programs that respond to agricultural market fluctuations, delivering payments that are inversely related to market performance.

The United States has a long history of government programs directly and indirectly supporting farmers and their income, dating back to the Great Depression and Dust Bowl eras. Over this time, the objectives of farm policy have had to meet varying needs, and have endured numerous iterations from their onset to today. Most recently the reforms of the 2014 Farm Bill redirected farm payments from constant income transfers to countercyclical payments which mimic insurance indemnities by paying out only when certain financial stress thresholds are met for a given area of the country.

This thesis offers a study of 92 counties in Indiana covering corn, soybean, and wheat crop production representing the majority of Indiana crop revenue. The analysis

predicts payment rates by county for the scheduled life of the 2014 Farm Bill commodity programs, 2014-2018. We adopt a baseline approach for extending the analysis forward beyond the period of known prices and yields, opting to calculate a relatively stable path analysis of programs under forecast equilibrium. This offers the advantage of seeing how the "memory" of the Agricultural Risk Coverage program carries forward in time with its basis in moving averages of revenue components.

The 2014 and 2015 known payments are of considerable interest across the different crops in Indiana, providing the full range of outcomes and allowing direct contrast in payment streams for different counties. The scope of the analysis and the "natural experiment" of 2014 and 2015 price and yields across crops and space in Indiana allows for some generalizations on the efficacy of the 2014 Farm Bill's programs in their support to agricultural producers and their ability to limit federal budget outlays. In both cases we focus on per acre payment rates at the county level against Direct Payments.

Our focus on payment rates gives us a basic unit for analysis that both facilitates decomposition into the factors that influence the payment rate as well as leaving aside the issues involved with appropriate aggregation methods over heterogeneous population with limited data. The analysis shows that the three crops in Indiana can generalize to 3 cases when comparing the two new programs (ARC and PLC) to the replaced direct payments (DP) but that these generalizations mask some distributional issues that occur in payment rates at the county level. The decomposition of payment rates among multiple dimensions (prices, yields, counties, programs, and time) permits examination of the full set of potential economic and political consequences of current and future instances of commodity support policy.

CHAPTER 1. FOREWORD

The commodity title of the 2014 farm bill features two primary support programs designed to support farm incomes when individual commodity markets decline, Agriculture Risk Coverage (ARC) and Price Loss Coverage (PLC)[1]. The 2014 farm bill's commodity title is novel as a subject of study for its flexibility in allowing producers to choose program coverage as well as for its thematic reversion to direct linkages between current market performance and payment levels. The timing of the 2014 farm bill adds an additional note of interest as it marks the turning point from high market prices that persisted through much of the previous farm bill's lifespan.

The strong price performance immediately preceding the 2014 farm bill is particularly notable in the case of the ARC program, which is tied to a set of recent historical prices and yields with its moving average calculation. The role of these historical yields and prices on average and in the timing of when they occur has a profound effect on the path that support payments take through time. Additionally, the use of yields in the payment calculation introduces spatial variability such that county productivity and variability are instrumental in determining eligibility for program

[1] A third income support program named Agricultural Risk Coverage – Individual (ARC-I) was also introduced in the 2014 farm bill. This program is designed around whole farm support rather than being commodity specific. This program had limited sign-up and is not generally comparable on anything but a case farm basis. This thesis maintains county level payment rates as the unit of analysis leaving little room to provide conclusions with regard to that program.

support in any given year. These stand in stark contrast to the PLC program which sets statutory price floors for each crop that do not respond to changing market or production conditions.

This thesis consists of two papers each pursuing a different aim for understanding the 2014 Farm Bill's commodity title and its PLC and ARC programs. Chapter 2 offers a discourse on the history of commodity support policy in the United States. This discourse aims to identify the major tonal shifts in farm support policy and the market conditions to which program design responds. Upon arriving at the significant shift in policy approach offered by the 2014 Farm Bill, the paper concludes with some thoughts about expectations for the future design of government support in agriculture.

This is immediately followed with the 2nd paper which offers an investigation into the distributional implications of the 2014 Farm Bill. The paper identifies five dimensions or "lenses" through which to examine the primary program options of ARC and PLC. These include two dimensions specific to the signup process (crop and program dimensions) and two dimensions that arise from agricultural performance both relative to program defined benchmarks (yield and price dimensions). The final construct is in many ways a measure of how the previous four interact through the life of the program (time dimension).

The two papers in this thesis are written in standalone fashion so that a proper introduction to each paper's subject matter and objectives can be found in the opening sections of chapter 2 and chapter 3 respectively. While the essays denoted chapter 2 and 3 are intended to stand alone, they are bound by a thematic thread of trying to understand and inform policy maker actions and responses.

Policy objectives within omnibus farm legislation are increasingly diverse. The long history of farm policy reform efforts is marked by a high disposition for political response to current economic conditions, often through the use of interstitial assistance in times of marked distress. At the conclusion of chapter 2 it is observed that a critical aim of the 2014 Farm Bill's design is to retard the political impulse to intervene by formalizing the dependency of the rate of payments to the relative performance of the sector. This observation provides a natural bridge to chapter 3 which will examine the effectiveness of 2014 Farm Bill mechanisms with an eye toward some distributional consequences and their interactions that may exert unanticipated political pressures.

1.1: Explaining Payment Estimations for Indiana over Space and Time

Chapter three provides the estimation of program payments, followed by an analysis of the prices and yields components for select cases to show the variability than can occur in fairly localized settings under ARC. The first step is calculating the expected relative price support in PLC vs ARC and reviewing the role that played in differential crop enrollment across programs in Indiana. From there, the examination of yield effect on subsidy levels becomes the driving factor both in calculating the current year's payment and nearly as important, in contributing to the following year's benchmark revenue level that triggers payments. For example, two counties will have the same low national price for corn used in their ARC calculation but will differ in payment by their yield factor (current yield relative to historical). If one county has a strong enough yield to overcome the price factor so that revenue remains above the benchmark, that revenue performance will be carried forward providing a (relatively) stronger support basis for

subsequent years. By definition a county that receives a payment in one year will be lowering its supported revenue level in subsequent years. Examining the varied cases that occurred across Indiana's strong 2014 and weak 2015 productivity provides considerable fodder for comparison and developing some general findings on relative program performance.

1.2: Policy effectiveness: Income Support and Public Spending

The relevant point of comparison for ARC and PLC payments is the foregone direct payment program that supported US agriculture with fixed transfers independent of market outcomes for nearly twenty years. The potential for program funds to support farm income is increasingly limited in the general sense and requires a high resolution examination of farm types to identify those farms where support programs are relevant to the net profitability margin over multiple years. Analysis of farm payment usage during the era of decoupled direct payment support showed a variety of uses made of those direct payments. Regardless of an individual farm's income status or utility from a direct payment check, that money was a constant addition to the farm's market income. The reform to a countercyclical basis (payments inversely related to market performance) means that our best measure (absent the distributional incidence) for placing new programs on a relative basis is the assumed continuation of a constant DP payment rate.

Adopting the DP as a point of comparison readily highlights the role of fluctuating versus constant payments. Additionally, it provides some insight on potential program costs vis-à-vis a continuation of the DP program as the primary commodity program outlay. As debate on 2014 farm bill reached its ultimate resolution there were

two clear critiques of the commodity title's reliance on direct payments. First was the identical payments being made year over year even when farm incomes were growing. The second was the level of spending on commodity entitlements. It is clear that the reform track favored the variable payments at the expense of spending as the new counter-cyclical programs increase budget exposure in the commodity title such that relatively strong and consistent market performance would be required to lead to reduced commodity title spending. Most national baseline projections currently indicate that commodity title spending will increase over the five-year life of the bill significantly, a conclusion that is supported in our comparison of payment rates across Indiana's 92 counties.

CHAPTER 2: AN EXAMINATION OF HISTORICAL US COMMODITY SUPPORT

The roots of U.S. commodity programs can be traced to the economic conditions of the 1920's and 1930's and the socioeconomic motivations of Roosevelt's New Deal approach to federal government policy. Farm programs or commodity support are generally defined as the set of federal instruments that insulate farmers from market losses or provide direct income support in the form of a monetary payment. The initial farm programs enacted under Roosevelt set the stage for some sixty years of support in agriculture by providing farmers insulation from downside market outcomes in exchange for some participation requirements that limit total crop supply.

These limitations on supply control took many forms and represents the first big idea in commodity support defining farm support from its onset to 1996. The consistent activity of the government as an intervening agent in agricultural markets was understandably a complicating factor for those who rely on market signals for profit making decisions. The marginal success and the consistent need for overhaul of program mechanisms over time led to decreasing reliance on supply control as the end of the 20th century neared and the supply control era officially ended in 1996. In that year, the government ended all market based purchase and stockholding and shifted programmatic support in agriculture to the second big idea, decoupled support. Decoupled in

agricultural support is a term that has come to mean government payments that are not impacted by current market performance or on-farm decisions.

The first decoupled payments instituted in the US were fully decoupled using historical factors to determine payments levels on a per acre basis with no response to market factors. Moving forward from 1996, different forms of decoupled payments were instituted some of which were only decoupled from on-farm decisions with payment levels that respond to annual market prices. The experiment with decoupled support was marked by two things: first of these was allowing significant flexibility for farmers to respond in their production decisions without having to consider payment eligibility implications and second is a high rate of emergency support being required in different years where markets plummeted. In 1999 and 2000, record low prices spurred emergency support in agriculture at rates large enough to set record levels of government payments (in nominal spending dollars) during those years despite a set of policies designed to ignore market performance.

We define the end of the decoupling era as 2014, when the US eliminated all fixed direct payments. These payments were the hallmark of 1996 policy and ironically it was the fact that these fixed direct payments continued despite record farm income performance that made them politically untenable. As the US economy struggled through recession and budget crisis in 2011 and 2012 farm incomes thrived and put direct payment support on notice for elimination with no meaningful legislative champion arguing for their maintenance. The passage of the 2014 farm bill sets the modern big idea of agricultural commodity support, featuring as its big idea insurance-like countercyclical support that deters the need for emergency support. In the sections that follow we discuss

the historical track of US commodity support in detail, noting the several reform efforts and how past mechanisms inform expectations about performance of the 2014 farm bill. We close relating 2014's farm bill in the historical context and assess its potential for meeting expectations, avoiding unintended consequences, and sustaining agricultural income in a manner consistent with policy objectives.

2.1: Commodity Program History Prior to 1996

The period from 1909 to 1914, sometimes known as the Golden Age, established the first modern era of sustained prosperity in US agriculture. As the weight of other social, political, and other economic factors brought downturns and increased uncertainty back to US agriculture, the first notions of adopting a public policy approach for sustaining agricultural incomes arrived (Bean and Bollinger 1939; Boulding 1947). The earliest experiment in US commodity support traces to 1919/1920 when low agricultural prices led to the Commission of Agricultural Inquiry's (CAI) report advocating legislation to regulate stocks, freight costs and credit conditions while promoting cooperatives (Gardner 2009). This period also marks the first use of the term parity, a belief that the five-year period preceding 1914 represented the proper returns to agriculture and that declines in agriculture were the result of outside forces intruding on agricultural market performance illegitimately.

Following the CAI report, private industry and select senators began to develop proposals for direct price intervention using the basis of emergency price controls enacted during the war that included price floors designed to encourage crop production patterns consistent with US and allies war efforts (Kennedy 2004). The first non-wartime direct

commodity market intervention was implemented under the Agricultural Marketing Act (AMA) of 1929. The AMA established the Federal Farm Board to manage support for wheat prices via the Grain Stabilization Corporation through a purchasing program that procured grain at support price levels and sold excess stocks overseas or stored until market prices rose in response to domestic shortage.

The Agricultural Adjustment Act (AAA) of May 1933 followed as the next attempt at farm price supports, passed as one of the bills implemented as part of Roosevelt's New Deal. The major reform differentiating the AAA from the previous effort was the emphasis on managing commodity prices through supply side incentives (Gardner 2009). This marked the beginning of supply management, a method to increase farm revenues by limiting overproduction and resultant price declines. The AAA also created the Commodity Credit Corporation (CCC), a government enterprise providing non-recourse loans to farmers with crop serving as the sole collateral. Loan programs (in various forms) have been a consistent feature of US price support establishing minimum prices for crops set legislatively.

These loans were made on a per bushel basis at a specified loan rate at harvest giving the farmer the option to market the collateralized harvest if prices rose high enough above the loan rate to cover transaction and interest expenses. Being a non-recourse loan, the CCC would take the collateral at no penalty to the farmer if prices were not high enough, and the crop would be held by the government for price stabilization or other public policy efforts. Loan programs beginning with the FAIR Act of 1996 were changed dramatically, ending the option to deliver harvest to government stocks programs due to the high cost and uncertain procurement entailed (Schertz 1999).

Supply management apart from the role government stocks played in loan programs has its own complicated history in US commodity policy. As Hertel summarized, the economics of agricultural production dictate that supply control as a policy conceit is at best a short run countercyclical measure and is self-defeating in the long run (Hertel 1990). These economic factors simply stated are: income and price inelastic demand for agricultural outputs, and the retention of productive resources in agriculture leading to excess capacity. Efforts to arrive at a workable supply control program persisted over the sixty-year period from 1930 to 1990 despite the economic precepts opposing success. The federal government experimented in the late 1970's and 1980's with subsidized Farmer-Owned Reserve programs to encourage farmers to expand storage of grain for marketing after the low-price post-harvest period.

Acreage-idling programs served as the second mechanism for supply control, either mandating that farmers to set aside arable land to qualify for price supports or paying rental fees for dedicated set asides to meet conservation goals. The AAA served as the initial experiment with managing supply through set-aside land. Land idling and land retirement programs were featured throughout the twentieth century, most recently in the long-standing Conservation Reserve Program (CRP) which provides rental contracts to farmers that set aside land which is sensitive to erosion or provides other environmental services. While the CRP has an explicit goal of setting aside land for non-market benefits, i.e. to secure environmental benefits, its initiation coincided with a number of supply control efforts including the Payment In Kind (PIK) program that paid producers in stored government crop for idled arable land. (Hertel 1990, Richardson 1999)

The PIK program ended up being a costly experiment with double the expected signup and a regional distribution of grain stocks that severely increased management costs. Abandonment of PIK left the Acreage Reduction Program (ARP) as the only remaining supply explicit supply control measure. The passage of the 1996 farm bill ended the ARP, closing the book on land retirement as supply management in US farm policy (Doig, 1983). The increasing reliance on agricultural trade and considerable administrative cost and misallocation repeatedly brought supply control motivated set-asides under critical fire. The program is most notable for its errant policy directives that deterred US farmer response to market signals, such as the 1972 call to increase set-aside wheat acreage even as export demand began a sharp increase. This shortage would be dubbed USDA's "great food fumble". A similar incident happened in 1995 when close to 20 million acres were idled creating an induced shortage that ran up prices and provided the strong market environment for passage of the 1996 farm bill. Outside of these dramatic examples the ARP program repeatedly failed to meet supply reduction targets due to "slippage" factors that saw farmers set aside least productive land and thus minimize the actual output reduction (Ericksen and Collins, 1983).

The reformed commodity policies of the FAIR Act of 1996 (Federal Agriculture Improvement and Reform Act) provided the initial foray into decoupled direct payments and the end of acreage reduction programs in the US. The legacy of ARP is evident in figure 2.1 showing the slow reduction in mandated set-asides in response to the mid-1980s farm crisis. The limits these placed on supply potential nearly doomed the experiment with decoupled support as large market losses required repeated emergency subsidy funds in the beginning years (1997-2000) of the FAIR Act's new subsidy

program of payments that were de-linked from production and prices. Figure 2.1 illustrates the amount of acres idled through programs in the twentieth century.

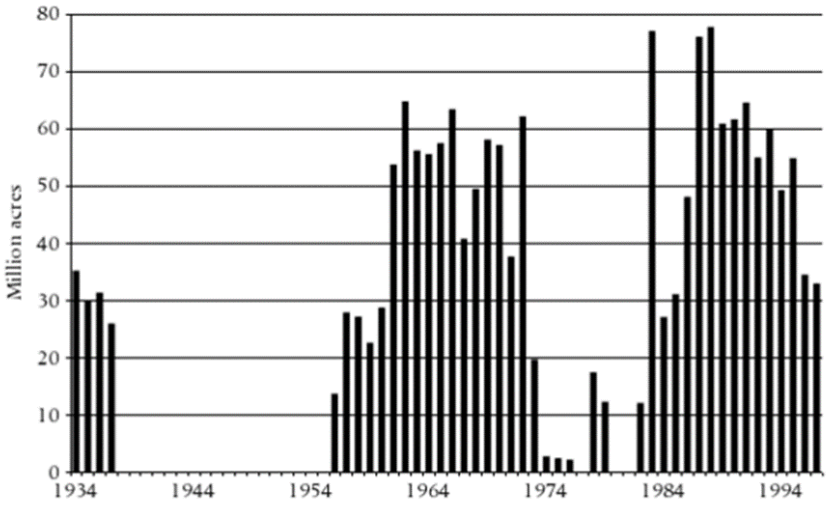

Figure 2. 1 History of Acreage Idled in US Production (source Bruce Gardner's: American Agriculture in the Twentieth Century)

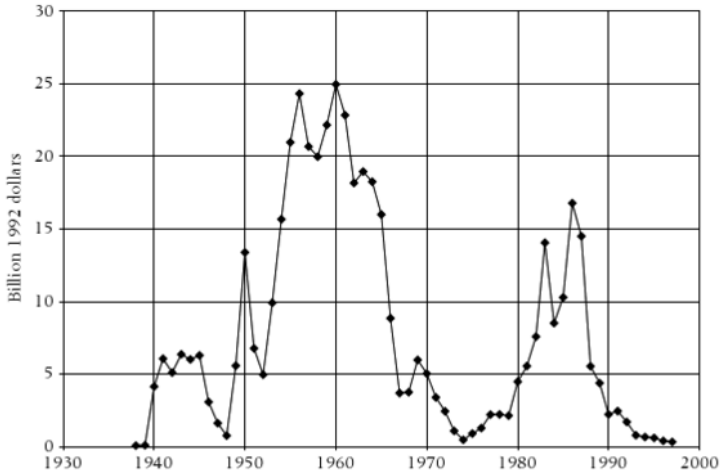

Figure 2. 2 Value of Government Inventories (source Bruce Gardner's: American Agriculture in the Twentieth Century)

Government use of non-recourse loan programs fostered dissatisfaction with the storage of excess grain only to subsequently dump it onto the market when market prices

rebounded. Storage of grain came at high cost to the government to purchase and the disposition of stocks led to markets consistently being influenced through government intervention either via the support price offered to farmers or the sell-off of acquired stocks (Gardner 2009). Figure 2.2 illustrates the total value of inventories over the history of government grain storage. Notably, the government held over 15 billion dollars (US$1992) in commodities during years from 1954-1965 which eventually led to reforms of the Agricultural and Consumer Protection Act of 1973 to introduce deficiency payments to complement and limit the influence of supply management. Deficiency payments are triggered by legislated support price targets, paying farmers the difference between the target price level and actual market price and form the mechanistic basis for numerous subsequent commodity support programs that followed through subsequent revisions to the farm bill's commodity title.

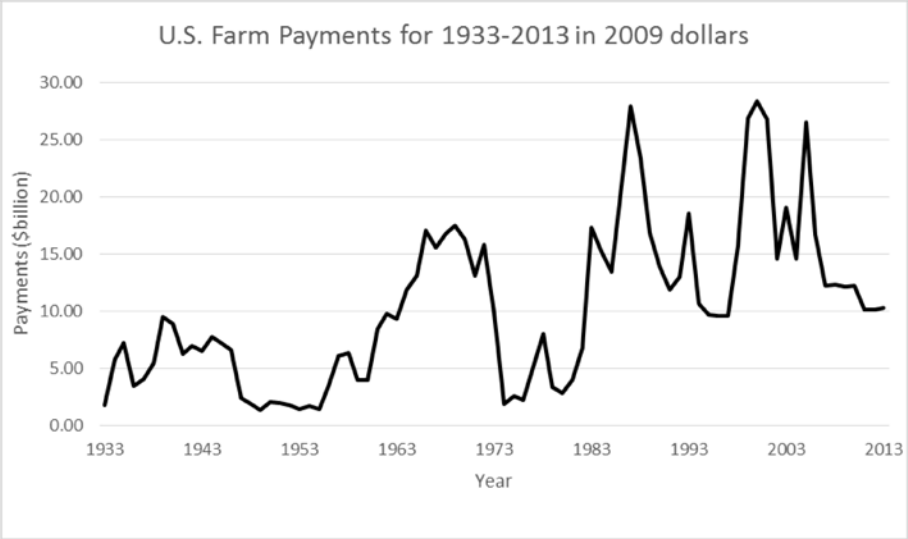

Figure 2. 3 American Farm Support Payments from 1933-2013(source: ERS-USDA)

In overview, the Federal Government has exerted considerable influence over agricultural markets via commodity program since the Great Depression. Federal payment expenditures have been a major topic of debate in program implementation with farm bill spending on commodity support being constrained to spend no more than its current baseline projection with each farm bill reauthorization. Figure 2.3 illustrates total government program expenditures throughout the twentieth century. Payments average some 10 billion between 1965 and 1990 in 1992 dollars though they largely track market performance, exceeding that average in the years between the periods of 1965 to 1972 and 1983 to 1990 when agricultural market slumped. The payment levels peaked in 1987 with an expenditure of over 20 billion. Both the high level of spending and the role government's intrusion played in distorting the function of agricultural markets sparked a large debate that would culminate in the in the 1996 FAIR Act's reform package for agriculture that led to its more recognized nickname "the freedom to farm act".

2.2: Post-1996 U.S. Commodity Programs

The post-1996 period is marked by a consistent approach to commodity policy, with direct payments made on the basis of historical acreage serving as the common means through all iterations of the farm bill's commodity title to 2014 (ERS-USDA 2016). The Federal Agricultural Improvement and Reform Act of 1996 (FAIR), the Farm Security and Rural Investment Act of 2002, the Food, Conservation, and Energy Act of 2008, and the Agricultural Act of 2014 have all been passed with either direct payments as a prominent feature of support or (in the case of 2014) reforming the constant payout of direct payments as an explicit goal.

The 1996 farm act implemented multiple commodity programs that would be in effect from 1996 to 2002. Production Flexibility Contracts (PFC) and non-recourse loans served as the primary commodity programs that were expected to transition US crop agriculture away from federally funded income and price support (Richardson 1999). The PFC program was a landmark change in agricultural support, implementing a set of prescribed payments from 1996 to 2002 while using historical yields and planting as the basis for subsidy receipts irrespective of current farm decisions and market performance. These contracts required producers to comply with all conservation provisions and planting flexibility provisions to maintain eligibility, but otherwise offered limited influence over producer decision-making (ERS-USDA 2016).

The PFC program required each producer to establish a base acreage level for each eligible crop on their operation, a feature still used in commodity payments and that has intermittently been subject to allowed updates to more accurately reflect the farm's recent history of production. The PFC program of the FAIR act established the role of payment yields, a fixed level of production tied to each base acre that is used to form the historical production level for support. Finally, PFC payments were made by commodity on 85 percent of base acreage, a factor the government can use to control spending levels though it has remained at 85 percent of base acres for most program implementations subsequent to 1996. PFC contracts introduced payment limits on an individual basis, establishing a limit of $40,000 per person and $80,000 under the three-entity rule (ERS-USDA 2016).

PFC payments represented the bulk of expected farm commodity support under the 1996 farm bill though nonrecourse loans were continued under the FAIR Act. The loan program allows farmers to obtain loans at a specified per-bushel rate by using the crop as collateral with the loan rates for corn, soybeans, and wheat set to 85 percent of the olympic 5-year moving average of prices. In this regard the loan rates of the 1996 farm bill resemble the benchmarking process of newly formed programs in 2014, which look to the preceding five-year history of yields and prices for establishing payment thresholds for commodity producers.

The 2002 farm bill initiated the first program labeled “direct payments”, which were nearly identical in structure (base acres and yield assignment) and independence from market factors to the PFC payments of the 1996 FAIR Act. Direct payments are made on fixed per-bushel rates of $0.52/bu for wheat, $0.28/bu for corn, and $0.44/bu for soybeans, values that continued through the life of the direct payments program from 2002 to 2014. The payment quantity is derived from multiplying 85 percent of the commodity’s base acreage by the commodity’s program yield for that farm. Additional to direct payments and the continuation of the loan program, the 2002 farm bill introduced counter-cyclical payments (CCP).

This unique addition to the 2002 Farm Bill was introduced to formalize the emergency response spending that were required to increase agricultural income support for many places in the country when farm prices dropped precipitously in 1997 and 1998. The counter-cyclical payments were designed to trigger when effective prices (national average prices plus the direct payment rate per bushel) fall below a target level

established in the legislation (Gray 2002). Target prices of $3.92/bu, $2.63/bu, and $5.80/bu for wheat, corn, and soybeans respectively set the CCP program triggers for most of the 2002 farm bill's span. These CCP payments (like direct payments) were made based on historical yield factors and base acreage but are triggered by current market performance. This dual reliance on current and historical information makes for a program that has limited influence on current decision making because farmers cannot influence the size of the payment received through any on-farm decision.

Non-recourse loans became marketing assistance loans to reflect the "bridge" nature they have come to play in assisting farmers with loan benefits that effectively set a floor under prices and provide some flexibility in timing of sales. The loan rates for wheat, corn, and soybeans are significantly lower than the CCP target prices at $2.75/bu, $1.95/bu, and $5.00/bu respectively (Gray 2002). This tiered support is by design with CCP's providing partial payments on a historical basis but in response to current market conditions. Marketing loans are directly tied to current prices and planting so that they provide the ultimate floor under the actual crop produced.

The Food, Conservation, and Energy Act of 2008's commodity programs include direct payments, counter-cyclical payments and a new optional program, the average crop revenue election program (ACRE), in addition to continued marketing assistance loans. The direct payments were little changed in program design, continuing payments on 85 percent[2] of the base acres and at rates of soybeans are $0.52/bu (wheat), $0.28/bu (corn),

[2] Direct payments were paid on only 83.3 percent of base acres during 2009 and 2011 in an effort to bring the farm bill in under its baseline spending limit for the five year life of the program.

$0.44/bu (soybeans) respectively. Farmers were offered the choice to forego twenty percent of their direct payment rate in exchange for an enrollment in the average crop revenue election (ACRE) program (Johnson 2008).

The counter-cyclical payments continued in 2008 with $3.92/bu, $2.63/bu, $5.80/bu payment rates for wheat, corn, and soybeans respectively. Over the course of the five years of the 2008 farm bill these target prices adjust to $4.17/bu, $2.63/bu, $6.00/bu respectively (Johnson 2008). Producers who elect to enter the ACRE program alternative forego their CCP coverage in addition to the twenty percent reduction in their direct payments. This established the ACRE program as a revenue alternative to counter-cyclical price support and set the stage for the menu of programs that eventually emerge in 2014 in the subsequent farm bill.

The average crop revenue election (ACRE) program was introduced as part of the process of making crop subsidy support behave more like crop insurance with payouts inversely related to income performance measures. In that sense, the 20 percent reduction in direct payments and an additional 30 percent reduction in marketing assistance loans could be thought of as the premium payments for the ACRE insurance subsidy. ACRE payouts occur when a complex two-trigger set of criteria is met. Enrollees receive a per acre payment if the state average revenue (on a per acre basis) falls below 90 percent of the state benchmark calculated from a 5-year benchmark state yield and a 2-year national price average.

The 5-year benchmark yield is an Olympic average of the previous 5 years' yields with the lowest and highest state average yields by crop omitted from the 5 year average

calculation. The national price average is the average over the most recent two years with the loan rate guarantee price replacing the national price in years when market price is too low. To receive payments individual farms must show a loss against their individual benchmark revenue (calculated the same as for the state) and be in a state that has a minimum 10% shortfall of average revenue.

Actual payments to farms are modulated by a farm specific productivity ratio that looks to the farm's specific 5-year olympic average yield divided by the state benchmark yield. The per acre payment rate is equal the lesser of the difference between the 90 percent benchmark for the state and 25 percent of the state benchmark for a given commodity. ACRE introduced farm operators to revenue based subsidies bringing both yield and price factors to bear in determination of payment levels for farmers.

2.3: The Agricultural Act of 2014

The most recent farm bill is the Agricultural Act of 2014 (AA14). This farm bill was passed amid some of the most volatile budget debates in modern US history with the nutrition title and its assistance to low income families a primary target of budget hawks. The much smaller spending on the commodity title has lower potential budget impact but was made to fall in line showing significant contributions to deficit reduction when compared against baseline forecasts for spending.

Despite the discord in farm bill negotiations, there was universal support for ending direct payments. Once the dominant rhetoric around direct payments became 'they pay farmers identical amounts even in record farm income years' there were no

vocal defenders of the program that had fostered an agricultural sector that was able to respond to market forces and thrive during the Great Recession. The 2014 farm bill featured across the board reform with every program eliminated and in some instances replaced by close or distant cousins in terms of design.

As a replacement for the CCP program the 2014 farm bill adds price loss coverage (PLC) as its counter-cyclical price support initiative. The ACRE program with its complex dual-trigger payment calculation is replaced by the simplified Agricultural Risk Coverage (ARC) county option (ARC-CO) which localizes the revenue protection aspects of ACRE to the county level and eliminates on farm factors for determining payments. Farms that desire on farm determination of payments must opt into the second option of the ARC program, named the individual coverage (ARC-IC), a program that comes at significant penalty relative to ARC-CO as farmers only receive payments on 65% of base acres instead of the traditional 85%.

The new mix of programs is clearly envisioned as more of a safety net for producers with a localization of support that depends on the county where production is located. Producers were required to evaluate all potential options of the farm bill and elect their base acres into one of the program options for the duration of the farm bill.

The price loss coverage (PLC) program operates similar to the counter cyclical payment program in that it relies on a change in price to implement payments. Payments are triggered within the policy whenever the market price falls below the respected commodity's reference price. The reference prices for wheat, corn, and soybeans for the duration of the farm bill are $5.50/bu, $3.70/bu, and $8.40/bu respectively, a marked

increase from past CCP support reflecting the market conditions transpiring since 2008 farm bill passage.

The ARC-C and ARC-I programs differ from the PLC program functionally by the role yield plays in determining payments. The producer may choose to enroll in the county level or the individual level, but the individual option requires the farm to have complete farm data for yield and revenues. There are also some differences in payment calculation as well. The county option payments can be implemented when the actual county per acre revenue drops below 86 percent of the benchmark per acre revenue, which is the product of the 5-year olympic averages of higher of loan rates or national price and county yield. The payment rate is calculated by taking the lower of the difference between the benchmark per acre revenue and the actual per acre revenue or 10 percent of the benchmark per acre revenue. The full commodity payment is then calculated by multiplying the payment rate by 85 percent of the commodity's base acres. The total payment then is the sum of all crop payments (Shields, 2014).

However, the individual option payments are triggered when the sum of the per acre revenue across all covered crops fall below the guaranteed per acre revenue. The guaranteed per acre revenue is calculated by taking 86 percent the benchmark revenue summed up across all crops. The benchmark per acre revenue is calculated by multiplying the 5-year olympic national price average by the 5-year olympic average farm yield for each commodity. The payment rate is then calculated by taking the lesser between the difference of the individual farm guarantee per acre revenue and the actual per acre revenue or 10 percent of the farm's benchmark per acre revenue. Then the total

per acre farm payment is calculated by multiplying the payment rate by 65 percent of the base acres for the farm (Shields, 2014). Even though payment calculation is slightly different between the two options, the two programs share many similarities to how they are triggered in the market.

Overall, the commodity program mix changed only gradually from 1996 to 2008 reflecting considered stability. The advent of the 2008 ACRE program as an optional alternative heralded the mindset to shift support to larger payouts when markets are weak and limiting payments when market and income performance are strong. The 2008 ACRE program found limited favor with those offered the option due to forecast market strength across many commodities and the complex trigger mechanism's use of state averages which often bear little relation to local production and revenue conditions.

The considered stability for the 18 years prior to 2014 was turned completely on its head with the elimination of direct payments, a constant addition to farm income that many producers had adopted as a certain component in financial and cash flow management. The new payment regime meant that market performance was guaranteed to determine when payments are made with considerable uncertainty about the final level those payments reach. Thus, 2014 began a period where the addition to farm income from commodity programs has no certain component to assist farmers in management and provides no reliable means for forecasting budget outlays for lawmakers and legislative staff tasked with monitoring and evaluation of the farm bill.

2.4: Recent Role of Government Farm Payments

Government payments have played a large role in supporting farm income through direct payments and safety net programs. In the five years prior to the 2014 Farm Bill, farmers have received direct payments, ACRE payments, counter-cyclical payments, and others. Just how these payments have influenced farm income is a topic of continued interest to farm policy analysts.

Government spending in terms of U.S. agriculture has fluctuated around 10 billion current dollars in the recent period between 2009 and 2014. Expenditure levels were 12.1 billion in 2009, 12.4 billion in 2010, 10.4 billion in 2011, 10.6 billion in 2012, 11 billion in 2013, and 9.7 billion in 2014 (USDA-ERS). The largest portion of these payments came from direct commodity payments, which averaged around 4.7 billion up until they were largely eliminated in 2014. The second largest spending factor came from conservation programs that averaged 3.5 billion dollars between 2009 and 2014. ACRE payments were not seen until 2010 and averaged only 187.8 million in spending until 2014, reflecting the limited appeal of the program in its 2008 incarnation. Counter-cyclical payments and loan deficiency payments averaged 287.6 million in spending in 2009 to 2014 as a result of relatively low support prices compared to the market strength of agricultural prices across the board.

Direct payments had the largest share of farm program spending, with the base acreage commitments identifying which crops these payments nominally support[3]. The

[3] Note that payments to base acres are not dependent on what is currently planted. Base acres are effectively frozen to some historical planting allocation so that a farm can grow continuous corn in year X yet have its payments made over a base acreage allocation that is split among numerous crops.

crops that received the largest portions of the direct payments can be approximately calculated using the income support rates per bushel, payment yields, and enrolled acres. Corn, wheat, and soybeans rank as the top crops respectively among all of the commodities receiving payments. Corn would receive an estimated 2.4 billion of the payments, which is around half of the yearly average. Wheat would receive 1.3 billion in payments, and soybeans would receive .68 billion of direct payment expenditures. The payments used on corn, wheat, and soybeans takes up the vast majority of direct payment spending.

The main objective of the commodity programs is to support farm income. Therefore, another interesting question is how important are these programs in supporting farm income in recent years. We can find the percentage of income that is from support payments by dividing the amount of government payments by the net farm income. In the years 2009 to 2014, government support payments have averaged 12.6 percent. The highest rate occurred in 2009 and 2010 with 19.6 and 16.1 percent respectively. These years also had the lowest farm income as well, which leads one to believe that farm income support programs become much more important in low income years. However, the 10 percent average in 2011 to 2014 is still rather important to income considering a farm with 100,000 dollars in annual income would roughly receive 10,000 dollars form the government. The government payments themselves would give farmers enough excess income to cover some input costs or invest in additional opportunities.

The recent 2014 Farm Bill marks the transition of American agriculture policy from direct farm support payments to counter-cyclical safety net programs. Since the 1996 FAIR Act, the majority of farm payments have not been tied to the economic

prosperity of the farmer and could be responsible for unnecessary support that could disrupt the natural market. For example, corn and sorghum producers received higher fixed support rate in comparison to target price than any other crop. From 1996-2014, corn and sorghum producers' ratio of direct payment rates to counter-cyclical trigger prices were .11 and .13 respectively while soybeans were just .07.

However, counter-cyclical programs like Agricultural Risk Coverage and Price-Loss Coverage would only provide support in down years depending on where the support prices are established. This means that there is no component of farm income that is certain and all government payment receipts will now only be resolved one full year after harvest when the national average marketing year price is determined. But this is not the only timing issue involved, the pattern of payments and the initialization of the 2014 farm bill's ARC county program at a time of record farm incomes plays a considerable role and will be a focus of the analysis in chapter 3. To better understand the motivation behind the choice to set these program options for farmers and to frame subsequent analysis the next section provides some background on the 2014 farm bill debate, a contentious two-year process that stands unprecedented for the difficulty of passage as well as providing signals about the future of farm bill legislation when the 2014 law expires.

2.5: 2014 Farm Bill Background

The Food, Conservation, and Energy Act of 2008 expired on September 30, 2012. When the bill expired the current programs under the bill technically lost their authority to distribute payments to agricultural producers. However, negotiations over a new farm

bill were going slowly, and the 2008 Farm Bill was extended twice. It was extended till the end of 2012 and then again until the end of the 2013 crop year (Monke 2013). Negotiations about a new farm bill continued well into the fall of 2013, and if the 2008 programs were not extended or a new farm bill was created the permanent laws of 1949 hovered as a looming threat that would authorize payments out of sync with any current view of markets and require specific de-authorizing legislation to eliminate the exorbitant payouts that would be scheduled under 1949 parameters. The failure to extend or create a new farm bill would increase spending dramatically because many of the permanent laws had high support prices or were of an older design that cost more (Monke 2013).

Programs that were extended were mostly with mandatory funding. Programs like the Marketing Assistance loans, Counter-Cyclical Payments, and even the 5 billion dollar a year direct payment program was extended until the end of the 2013 crop year (Monke 2013). Eventually, the 2008 Farm Bill had to be extended again on January 1, 2014 to keep the permanent laws out effect. Finally, the Agricultural Act of 2014 passed in February of 2014. Much of the hesitation to implement a new farm bill spurred from the debate over the amount of spending that should be in the farm bill.

The commodity programs within the Agricultural Act of 2014 were not entirely original in their design to distribute support farmers. The new programs in question, Agriculture Risk Coverage and Price Loss Coverage, are very similar to the Average Crop Revenue Election and Counter-Cyclical Programs respectively. ACRE would be viewed as a precursor to ARC in how they both distribute payments when the total revenue level falls below a set benchmark. Even though the two programs are similar, there were many adjustments made in the 2014 Farm Bill.

First, ARCE's state-wide average benchmark revenue was narrowed down to a county-wide historic olympic average. Other major changes include lowering the payment cap from 25 percent to 10 percent, minor calculation differences, and the addition of an individual option for ARC. Likewise, the CCP could be seen as a precursor to PLC in how they both depend only on price to trigger payments and have extremely similar calculations to determine payments. However, CCP was dependent on the direct payment program rate in determining the CCP payment rate. Since direct payments were discontinued, PLC was created.

The most influential change to the mix of commodity programs within the Agricultural Act of 2014 is the repeal of direct payments to producers. Since the 1996 FAIR Act, eligible crop farmers would receive a direct fixed payment every year determined by their base acreage for that period. The direct payments were not tied to any market factor like revenue or price, but were viewed as a direct way to support farm income. As stated previously, direct payments were the main source of spending in terms of commodity program spending. Therefore, direct payments were removed from the program mix in effort to reduce spending and make the program mix more of a safety net with assistance limited to low income years.

Similar to the motive of repealing direct payments, conservation programs were bundled together or repealed in an effort to reduce spending. Major programs like the Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), and Conservation Stewardship Program (CSP) were reauthorized. The largest conservation program, CRP, was reduced from 32 million acres to 24 million acres and was amended to include a wider variety of acreages that were under terminated programs

to reduce spending (Shields 2014). EQIP was combined with other wildlife programs and took a 5 percent cut in funding, and CSP was reduced in acreage from 12.8 million to 10 million acres (Shields 2014). Agricultural Conservation Easement Program (ACEP) and Regional Conservation Partnership Program (RCPP) were created to bundle the other numerous environmental policies that were under effect. The streamlining of the conservation title represented a significant yet undervalued effort taken in the 2014 farm bill. The lion's share of attention to conservation revolved around the debate that eventually saw conservation compliance regulations attached to participation in subsidized crop insurance programs (Shields 2014).

Nutrition provisions spending within the 2014 Farm Bill were one of the largest stumbling blocks for the agricultural committees' designing a farm bill after 2012. The House of Representatives membership favored a stripped down nutritional program that cut spending by 39 billion dollars over 10 years. Contrarily, the senate passed its version of a farm bill with a nutrition title that only contributed 4 billion to deficit reduction over the 10 year baseline markup of the bill. The wide gap in the two opinions within congress caused a long stalemate that led to the 2014 Farm Bill not passing until February 2014. Eventually, congress agreed to cut spending by 8 billion over the course of ten years (Shields, 2014).

The Supplemental Nutrition Assistance Program (SNAP) was the source of most of the budget cuts within the nutrition portion of the bill. Most of the cuts would be implemented in changes to SNAP eligibility and the calculation of benefits, which tightened down on more able-bodied adults. The Emergency Food Assistance Program (TEFAP) that distributes food aid to areas in crisis was amended to increase spending by

205 million over the course of ten years. Other portions of the nutrition section of the farm bill such as school lunches and the Commodity Supplemental Food Program faced some small amendments, but stayed relatively consistent.

2.6: ARC and PLC Sign Up

In chapter 3, the analysis will rely on to specific calculations derived from the ARC and PLC program parameters. Thus we review the implementation process that has occurred in the 2014 commodity programs. Enrollment was opened on October 6, 2014 to allow farmers a one-time opportunity to update base acreage and program yield for the duration of the bill. Farmers were then allowed to choose which programs they were going to participate in beginning in November 17, 2014. Eligible crops (covered commodities) for ARC include corn, soybeans, wheat, oats, barley, sorghum, rice, sunflower, rapeseed, canola, safflower, flaxseed, mustard seed, crambe, sesame seed, dry peas, chickpeas, and peanuts. Corn, soybean, and wheat are the main covered commodities in Indiana's planted acreage and represent the subject of our review and analysis.

A definite bias towards the ARC-CO program can be seen within the results of Indiana's 2014 Farm Bill commodity program sign up. Table 2.1, on the following page, reveals the data for program sign up for Indiana, Illinois, and Ohio. For Indiana, the ARC-CO option accounted for an average of 96.6 percent of farms and 96 percent of base acres across corn, soybeans, and wheat. Meanwhile, PLC accounts for the majority of the remainder with an average of 3.3 percent of farms and 4 percent of base acres. The ARC-

IC option only accounted for less than half a percent of both farms and base acres (FSA). The heavy favoritism towards ARC-CO in Indiana suggests that produces prefer the shallow loss coverage of the Agriculture Risk Coverage program at least as it performs given the initial conditions that existed for the 2014 crop year[4].

The program election data from Indiana is very similar to the neighboring states of Illinois and Ohio with the exception of wheat, which had a larger share under PLC. 23.4 percent of farms and 35.2 percent of acreage in Illinois and 14.4 percent and 17.5 percent in Ohio went under the PLC program. The election for the ARC-IC option still remains extremely low for the two states. One could assume that the region featuring Indiana, Illinois, and Ohio faces moderately homogenous circumstances that would prefer the shallow loss protection of ARC-CO. However, why there was little interest in the individual option of ARC across the states. A probable reason is that the individual option only pays 65 percent of enrolled base acres and requires a more extensive record from the individual farm to be eligible.

[4] The 2014 farm program election offered the unique situation where farmers could select the program that covered a crop that was already harvested since 2014 payments were applied retroactively given the signup choice in 2015.

Table 2. 1 Indiana and Neighboring States' Signup for 2014 Farm Bill Programs (Source: Farm Service Agency)

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Indiana	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres3**	**Farm Count4**	**Base Acres5**
CORN	2374	144860.09	104844	6570383.89	34	2905.84
SOYBEANS	1951	70743.34	93335	3675233.79	32	1477.29
WHEAT	2100	36351.41	33660	429897.47	16	158.77
CORN	2.21%	2.16%	97.75%	97.80%	0.03%	0.04%
SOYBEANS	2.05%	1.89%	97.92%	98.07%	0.03%	0.04%
WHEAT	5.87%	7.79%	94.09%	92.17%	0.04%	0.03%

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Illinois	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres3**	**Farm Count4**	**Base Acres5**
CORN	3951	257719.52	159556	12936089.08	216	21583.33
SOYBEANS	3255	161236.79	140474	6964923.98	188	11086.82
WHEAT	11125	305176.58	36338	561221.32	32	359.25
CORN	2.41%	1.95%	97.45%	97.89%	0.13%	0.16%
SOYBEANS	2.26%	2.26%	97.61%	97.59%	0.13%	0.16%
WHEAT	23.42%	35.21%	76.51%	64.75%	0.07%	0.04%

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Ohio	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres2**	**Farm Count3**	**Base Acres3**
CORN	2084	81180.56	89448	4073101.69	121	7497.37
SOYBEANS	2100	79923.85	80534	3116075.67	112	5495.21
WHEAT	7246	147311.38	43055	690446.7	77	1958.73
CORN	2.27%	1.95%	97.59%	97.87%	0.13%	0.18%
SOYBEANS	2.54%	2.50%	97.33%	97.33%	0.14%	0.17%
WHEAT	14.38%	17.54%	85.46%	82.22%	0.15%	0.23%

2.7: ARC and PLC Program Descriptions

The Price Loss Coverage program is the successor of the Counter-Cyclical Program that began in 2002. Like the Counter-Cyclical Payments the driving factor behind initiating payments is the price. Once the price of a specific commodity falls below the target price, enrolled farms will receive the smallest difference between the target price and the actual price or the lone rate on 85 percent of the enrolled acres for that commodity. The main objective of the program is to protect against deeper losses that could occur in times of variable prices.

The Agriculture Risk Coverage program is a farm revenue protection program that is the successor to the Average Crop Revenue Election program that began in the 2008 Farm Bill. Unlike PLC, the ARC program uses revenue to initiate payments. The program is designed to cover shallow revenue losses as it has a 10 percent of benchmark revenue maximum payment rate.

The ARC program gives the farmer two options when considering the ARC program, a county option or an individual option. The ARC-CO option distributes payments based on a county-wide 5-year olympic average to set the benchmark revenue. The payments would then be distributed when the county's average revenue drops below the average or benchmark revenue for that commodity (FSA).

The ARC-IC option differs by narrowing down the county average to a single proprietor average. This means that the farmer must have complete data submitted to the farmer to be eligible. Other major differences would be that payments are only made to 65 percent of the commodity's base acreage and that the farmer would not be eligible to enroll in the government supported Supplemental Crop Insurance (SCO) (FSA). A side by side analysis over the differences of the programs are presented in table 2.2.

Table 2. 2 Comparison of 2014 Commodity Program Features (Source: Farm Service Agency)

Program feature comparison

Atribute	Agricultural Risk Coverage: County	Agricultural Risk Coverage: Individual Option	Price Loss Coverage
Payment Triggers	86 percent of average county per acre revenue	86 percent of average farm per acre revenue	Price levels
Pay Basis	County basis	Farm basis	Program basis
Constant or moving average for calculation	5-year olympic Average	5-year olympic Average	Constant price floor
Payment Acreage	85 percent of base acres	65 percent of base acres	85 percent of base acres
Payment Cap	10%	10%	No cap

2.8: ARC and PLC Payment Equations

The payments that a producer receives from the Price Loss Coverage program is dependent on the change of prices that occurs for a covered commodity. Therefore, a change in yield would have no effect upon the payment that a farm would receive. However, the policy provides deep loss coverage that is only limited by controls on the total government receipts to an individual operator.

PLC payments are triggered once the national market year price falls below a commodity specific reference price. Once the payment is triggered, the payment is formulated by taking the difference in the benchmark price and the actual price and multiplying by the farm specific program yield. The program yield is updated by the Farm Service Agency to 90 percent of the farm's average yield from 2008 to 2012 (for those farms that elected to update yields). The product of the difference in prices and the program yield is then multiplied by a factor of .85 to discover the per acre payment.

$$\frac{Payment}{base\ acre} = (Reference\ price - Actual\ Price) * Program\ yield * .85$$

Table 2. 3 PLC Reference Prices in the 2014 Farm Bill for Select Crops (Source: FSA)

Crop PLC Reference Prices

	Corn	Soybeans	Wheat
Benchmark Price ($/bu)	$ 3.70	$ 8.40	$ 5.50

For example, if the price of corn fell to $3.50 per bushel, and the farms program yield was 165; the per acre payment formula would be (3.70 – 3.50) * 165 * .85 and would equal 28.05 per commodity base acre.

The Agricultural Risk Coverage program is designed to be a total revenue safety net. Therefore, the farm's total revenue is what triggers the ARC payments. However, because all farms with base acreage in the same commodity identify the same national price factor, yield is the determinant for differing payment rates across counties. Farms within a county will differ only by their base acreage in the covered commodity. The ARC program is divided into an individual basis program and a county basis program. Main differences between the two programs is that the farm must have enough data to have their own farm's average yield for payment calculation and the farm will face a steeper payment discount rate. The county discount rate is .85 and the individual rate is .65.

In the ARC-CO program, a payment is triggered if the actual revenue is less than the ARC revenue guarantee. The guarantee is 86 percent of the county benchmark revenue. The benchmark revenue is calculated by taking the 5 year olympic average of the yields and market year average prices. However, the payment rate must not exceed 10 percent of the revenue guarantee rate. The payment formulas for ARC-C and ARC-I are as follows:

ARC-CO

$$\frac{Payment}{Acre} = .85 * \min\{\big((.86 * Benchmark\ Revenue) - Actual\ Revenue\big), .10 * Benchmark\ Revenue\}$$

ARC-IC

$$\frac{Payment}{Acre} = .65 * \min\big((.86 * Benchmark\ Revenue) - Actual\ Revenue\big), .10\ Benchmark\ Revenue$$

ARC-CO outcomes:

$$\begin{cases} 0 & if \quad Actual\ Revenue > .86\ Benchmark\ Revenue \\ \frac{Payment}{Acre} & if \quad .86\ Benchmark\ Revenue > Actual\ Revenue > .76 * Benchmark\ Revenue \\ .1\ Benchmark\ Revenue & if \quad .76 * Benchmark\ Revenue > Actual\ Revenue \end{cases}$$

The programs are designed to support income in a vastly different way than the previous direct payment program that is responsible for the largest portion of income support in the previous farm bill. The programs are designed to be a safety net that is only used in downturn years instead of paying a fixed amount regardless of economic conditions. This method of income support is designed to reduce the amount of government spending on farm programs and reduce the amount of market influence the payments have. An example would be how under direct payments, corn received a larger payment rate per bushel than any other crop in reference to its market price.

CHAPTER 3: RESULTS AND ANALYSIS

3.1 Model Scenario

The scenario for the model used to calculate program payments for 2014 to 2018 is a single deterministic baseline projection. The motivation for using a single scenario is because of the data available and the analytical frame needed to accomplish the objectives. The model has the necessary data to calculate the payments for 2014 and the 2015 benchmarks exactly, since the 2014 crop year has been completed. Aside from 2014 and 2015, 2016 to 2018 are the only years of completely unknown information. For those years, the model assumes that the USDA price projections would hold true since other studies reveal a similar outlook. Outside of the information aspect of the decision, the one scenario model allows the analysis of the two known market shocks. The shocks are the current price decline and the large yield increase seen in 2014. The variance across counties in the model also provides a robust frame to evaluate the behavior of the 2014 programs versus the control. The stable baseline scenario also allows for the inclusion and evaluation of the "memory" aspect of the ARC moving benchmarks and holds an agnostic view of the future.

The model itself is a projection for 2014 to 2018 of program payments for all three programs using their own payment calculations in a GAMS program. The model

predicts the payments for corn, soybeans, and wheat producers in all 92 counties in Indiana. The counties are then broken down into 9 geographical regions using acreage weights. The only data needed for input in the model are the prices and yields. For prices, the USDA long-run forecast is used as it is unbiased and still allows for a sufficient analysis of program behavior. A variable rate of increase is used for yields which has a constant increase of 1.33 percent then add a variable rate that is the state yield divided by that counties yield. The variable rate includes the room of growth that lower yielding counties perceive. The average yield growth rate used in the model is 2.25 percent.

The model's primary output is the county level payment rates per base acre minus the 85 percent base acre adjustment factor. The factor is left out because of the assumption that it would not be included until payment rates were calculated. The ARC-CO per base acre payment rate calculation is straight forward because the actual payment is per base acre, but PLC and DP are on a per bushel basis. In order to transform the PLC and DP rates into a per acre basis, the model must incorporate the fixed yield factors that persist throughout the life of the program. The model uses 86 percent of each counties average yield from 2009 to 2013 to be the representative PLC program yield. The 86 percent is used instead of 90 because the FSA updated the average to be the 2008 to 2012 average, and many farm averages include the use of a much lower plug yield for years that did not report a specific crop yield. Therefore, the added 4 percent discount helps include the lower plug yields and the one-year discount. The resulting PLC yield is then used for DP as well under the assumption of that is how DP would behave if it was to be continued as a program.

Section 3.2: Introduction to Results

The GAMS model organizes the results in a unique way that allows the analysis of the 2014 commodity programs to be conducted across multiple dimensions that are useful to current policy debates. The levels of the dimensions of the analysis are in the order of crops, program, geography, price, and time respectively.

The first of the output dimensions are the specified crops, corn, soybeans, and wheat, which make up the majority of Indiana crop acreage. Then the model computes the payments for these crops by dollars per base acre for ARC, PLC, and Direct Payments, which all interact differently with the succeeding dimensions.

After the first two simple dimensions, the analysis delves into how the payments differ across geographical regions, which are represented by the 92 Indiana counties and the 9 agricultural districts. The agricultural districts are consistent with the USDA definitions. The geographical dimension has an interesting effect on how payments are dispersed across the state. For ARC, the diversity of payment levels across counties are extremely dependent on the historical and actual yields of each region because they all perceive a consistent price protection. For example, a county with historically low yields does not have to face the same actual increase in yields as higher yielding counties to achieve the same percentage yield increase needed to opt out of payments as a higher yielding county. In 2014, each county had to face a 29 percent increase in yields to not receive payments. A county that has an ARC benchmark of 200 bushels per acre has to increase by 58 bushels per acre to not receive payment; however, a 140 bushels per acre benchmark county only has to have a 40.6 increase. This is an example of a potential discrepancy of ARC payments. Unlike ARC, PLC and the control DP are not subject to

changing yields but is held constant by the fixed program yield. The program yield still varies by county, but are held constant throughout the life of the program as a means to calculate per acre payment. The geographical dimension also shows a relationship between the programs in how differing yields among counties could potentially affect the preference of ARC versus PLC and DP.

Market and program prices are the next dimension of the model output. For each program, prices have a different interaction with payment levels. For ARC, prices have a dual interaction in how they change the benchmark though out time. The changing benchmark could potentially force payment levels in a given direction. For example, payment levels could continually fall if the benchmark price is driven down by consistently low prices, which when income support is needed most. Unlike ARC, PLC has a constant reference price. Therefore, potential payment levels do not change with the program. The only variable factor on payment levels is the actual price. Finally, DP is not tied to prices and has constant payment levels throughout time. Interestingly, the price dimension also illustrates a relationship in the support level and preference between the programs as well. For example, figure 3.1 illustrates the price support relationship between ARC and PLC.

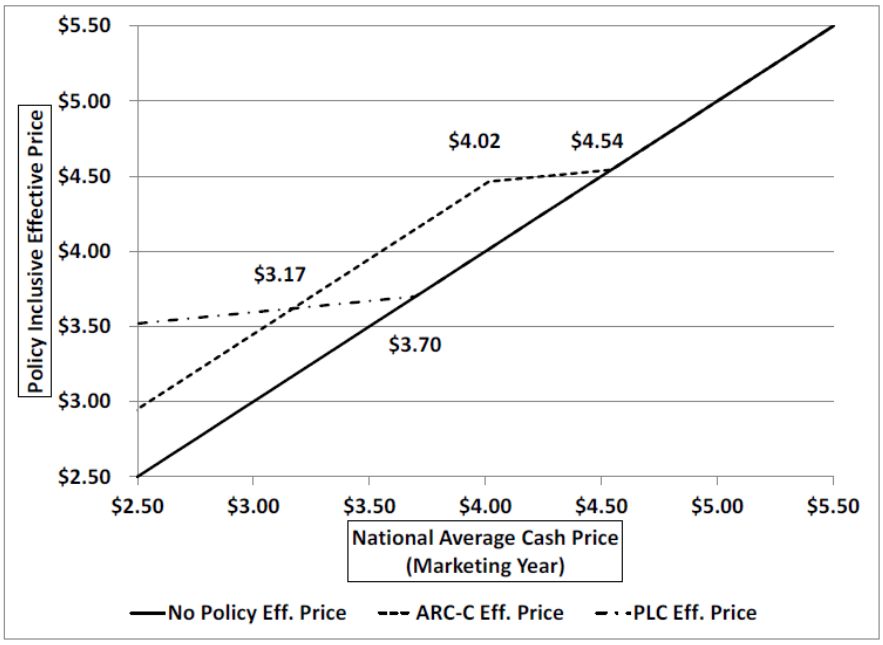

Figure 3. 1 ARC/PLC Payments Outcomes given a 4 Percent Yield Increase (source: Keeney)

The dashed lines show the 2014 payment levels for ARC and PLC assuming there is a 4 percent increase in yield. With the yield assumption, ARC begins to issue payments for corn at 4.54 dollars per bushel, and PLC issues payments at the reference price of 3.70 dollars per bushel. The figure reveals that ARC is the preferred program until the price falls to 3.17 dollars per bushel.

The last dimension of the results is how the programs interact throughout time. ARC has a complex relationship with time because of the moving benchmarks for price and yield. The way each of these behave annually can force the benchmark up or down and have a direct impact on the level of support. Price affects the benchmark consistently across regions but a constant decrease in prices could cause the benchmark revenue to decrease as well as the payment limit. Yield could also have the exact same affect, but

could vary greatly across counties and throughout time. However, the threshold for PLC is consistent throughout the life of the program and payment levels throughout time are entirely reliant on actual national prices. Unlike the 2014 programs, Direct Payments do not change throughout time.

3.3: ARC outcomes for all crops in Indiana in 2014

The outcomes for ARC are interesting for the role regional/local productivity and changes in that productivity play on a year to year basis. Price protection in the ARC program is initially strong with benchmark prices (the five year olympic average national price) for all crops well above expected market prices which are themselves somewhat higher than PLC support levels in general. An important note is that the results are the true ARC outcomes for 2014 based on actual data collected by FSA and calculated to generate county averages. Table 3.1 shows the ARC payments by crop for all the nine crop reporting districts of Indiana for 2014. The crop reporting districts are identical to those specified by the United State Department of Agriculture.

Table 3. 1 ARC 2014 Payment Outcomes for all Crops (source: author's calculations)

Regional 2014 ARC Payments Across all crops

Crop	Region	ARC 2014	Crop	Region	ARC 2014	Crop	Region	ARC 2014
Corn	NW	67	Soybeans	NW	2	Wheat	NW	0
	NC	47		NC	0		NC	0
	NE	22		NE	0		NE	0
	MW	15		MW	0		MW	0
	MC	13		MC	0		MC	0
	ME	39		ME	4		ME	0
	SW	14		SW	0		SW	0
	SC	1		SC	0		SC	0
	SE	0		SE	0		SE	0
	State	26		State	1		State	0

The fact that soybeans and wheat acres receive practically zero payments with the exception of the mid-eastern section for soybeans for 2014 represents an interesting contrast with the results for corn. The calculation would be a direct result of a statewide high yield for those two crops with marginally smaller price protection under the ARC program. The 2014 national price used for calculation of soybean ARC payments is $10.10 and the ARC benchmark price is $12.27. Likewise, the national price for wheat was $5.99 and the ARC benchmark is $6.60. Those current prices represent 21 percent and 10 percent deficits relative to benchmark prices used in the ARC revenue calculation. ARC payments are triggered when revenue falls by 14 percent so if yield is unchanged from benchmark levels soybean payments should receive payments and wheat should not be based on the price component of the program[5]. These differentials in the two prices for

[5] The linear approximation to the price and yield percentage change components impact on revenue is formally states as r = p + y where the lower case variables are percentage change in revenue (r), price (p), and quantity (q). As described in the text, this linear approximation would set -14 percent revenue change (r = -14) as the target requiring p + q to sum to -14. The linear approximation is imprecise for such a large LHS factor of -14 percent and should only be used as a general decomposition guideline as is used here providing context for evaluating yield components across counties.

each commodity means that yields must have only minor increases for soybeans or must have a minor decrease in the case of wheat to expect ARC payments to occur.

The fact that revenue is the product of price and quantity can be used as a simple estimation to determine how much the yield must increase to force no payments. The revenue must fall by 14 percent in order to distribute payments. Therefore, the average rate of price and yield difference must be less than -14 percent for payments to occur. The resulting yield percentage difference from the benchmark for soybeans and wheat should be approximately 7 percent and -4 percent for soybeans and wheat to generate ARC payments for base acres in those crops. In fact, the 2014 state average of both the yields for soybeans and wheat were +18.5 percent and +15 percent relative to the benchmark respectively 2014(FSA). Therefore, this simple approximation serves to explain the lack of ARC payments for both commodities. The effect that yield has on the statewide ARC payment levels is significant for soybeans and wheat. The average yield increase experienced by the two crops was high enough for them not to receive ARC payments for the majority of Indiana.

Unlike soybeans and wheat, corn producers in the majority of Indiana's geographic regions were the recipients of 2014 ARC payments. Like soybeans and wheat, the 2014 national price was well below the ARC benchmark set by the FSA. In this case, the difference is much more severe with a percentage deficit of 43 percent relative to the benchmark price. This differential suggests that if yield performance is similar to those previously discussed for soybeans and wheat then we should expect to find significant ARC payments and in some cases ARC payments that meet the limiting payout. The percent revenue drop must be −14 percent to initiate payments and must be -24 percent to

limit payments. The percent difference in 2014 average state yields and the FSA benchmark is 21 percent (FSA). This yield difference is larger than what is seen in both soybeans and wheat, but it is not generally large enough to overcome the 43 percent price difference making Indiana base acres for corn eligible for ARC payments.

The general scenario of all three prices being below the benchmark but most regions across all crops not receiving payments reveals the effect that yield has on the ARC payment calculation. However, the differences in the scenarios for soybeans and wheat in comparison to corn are a prime example of how the national price factor and local (county) yield factor determine ARC payments without respect to individual farm revenue performance. Thus, the ARC program is clearly an area support program that serves to infuse a region qualifying with an average revenue deficit with some federal support while farm specific instances on actual planting will require careful management of crop production, marketing, and insurance coverage to provide reliable stability to farm incomes.

The effect that yield brings to the 2014 ARC payment calculation for corn tells an interesting story about how yield determines the geographic distribution of payments across the state. For example, Indiana has a regional maximum of 51 dollars per acre in the northwestern region, but the south central and southeastern regions did not receive any payments. The wide margin results in a large variance across the state's regions. The average regional payment per acre for Indiana is 15 dollars per acre, but the standard deviation is 17 dollars per acre. The large standard deviation results in a heavy right skewedness from the average.

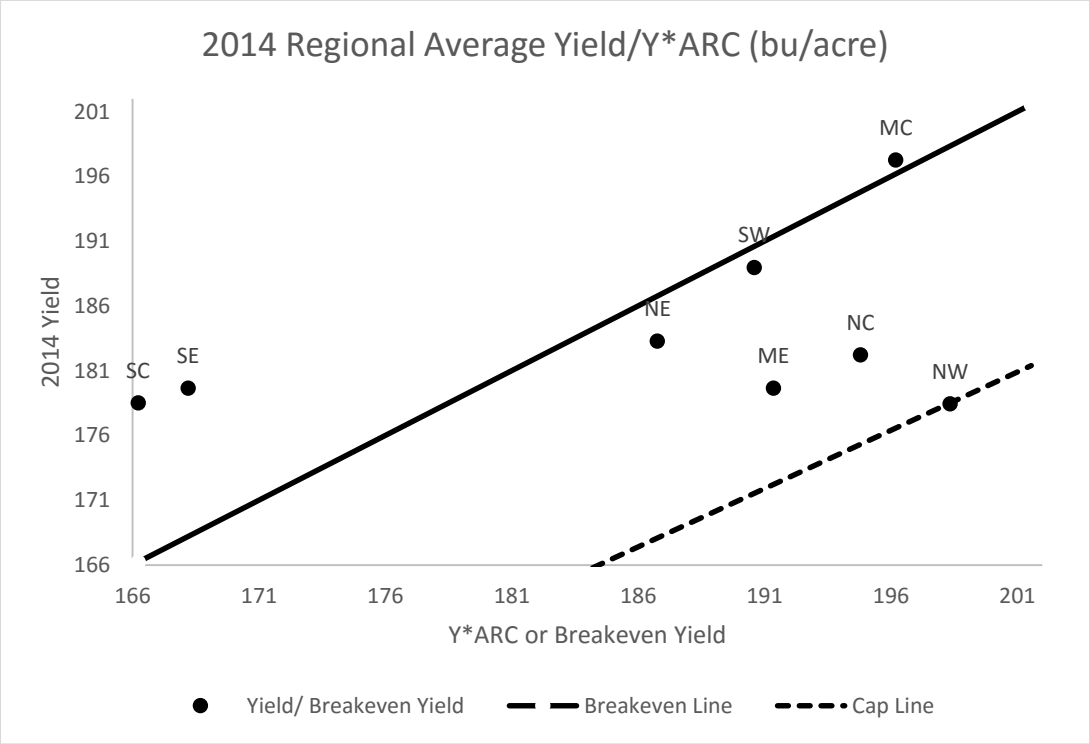

Figure 3. 2 Crop Reporting District Payment Aggregates under the ARC Program for 2014 (Source: Author's calculations)

Figure 3.2 shows the regional average actual 2014 yield on the y-axis over the regional 2014 Y*ARC. The Y*ARC is the target yield required to trigger a payment once prices are known[6]. The convergence point for each region is specified by the solid 45 degree line which puts a region squarely on the margin of receiving some positive payments level under ARC. The dashed line at the bottom of the graph identifies the ten percent (or ARC benchmark revenue) payment limit specified for the program.

[6] These trigger yields Y*ARC are calculated from the ARC payment formula as: Y*ARC = 0.86Yb x [Pb/Pt] where Pt and Pb are current and benchmark prices and Yb is the benchmark yield. The 0.86 factor makes this a trigger yield as that is the proportion of benchmark revenue that defines the margin between payments equal to zero and greater than zero.

There is some discrepancy between the figure and the table as the table shows some regions receiving payments while the graph does not. This is from the table being the average of payments and the graph being the average of yields. The discrepancy reveals an interesting fact that the northeastern, mid central, and southwestern regions would not have received payments if they were distributed on a regional basis. Disregarding the discrepancy, the figure describes the effect that yield has on the 2014 payments for corn. The south central and southeastern regions did not receive payments even with the 43 percent price deficiency because their yield was well above their local benchmarks measured at the county level. However, all of the other regions had at least some counties that received payments because they experienced yield increases that were small enough to stay under the payment trigger of the ARC program.

The main way that yield affects payments that each crop and region receives is by adding variability across the state so that differential income support is received even as the national average price basis for marketing is identical for all places. Price mainly affects the general level of payments everyone receives. However, yield is the only driver of regional payment differences and in any given year is the key factor for determining eligibility once the common price factor is identified. For 2014, yield has had a significant effect on soybeans and wheat not receiving payments and the payment variability seen in the different regions for corn.

3.4: Explaining County ARC Payments for Corn across Counties

The Agricultural Risk Coverage payments for 2014 results at the crop reporting district level can be further refined by moving to the county level where actual payments are calculated. As stated in the previous section, many producers in certain counties would not have received payments because other better performing counties would pull the revenue average above the benchmark. Therefore, it is worth analyzing corn payments on a more in depth level. Table 3.2 shows the 2014 county ARC payments results for the northwestern, north central, and mid-east regions of Indiana.

Table 3. 2 2014 ARC County Corn Payments across Regions (source: author's calculations)

2014 ARC Payments for NW,NC,ME

Region	Counties	ARC 2014	Region	Counties	ARC 2014	Region	Counties	ARC 2014
NW	Benton	28	NC	Carroll	18	ME	Blackford	84
	Jasper	84		Cass	0		Delaware	44
	La Porte	31		Elkhart	18		Fayette	0
	Lake	83		Fulton	76		Henry	29
	Newton	88		Kosciusko	84		Jay	51
	Porter	86		Marshall	45		Randolph	50
	Pulaski	82		Miami	42		Union	38
	Starke	59		St. Joseph	83		Wayne	6
	White	64		Wabash	50			

The table shows just how varied the payment levels can be within a certain region. For example, there are multiple counties that receive no payments while some payments are approaching or are at their respective maximum payment level. The mid-east region is particularly noteworthy for the fact that Blackford County requires a maximum payment level while Fayette County did not net a positive payment. In addition, none of the counties that required payments would have received them if

payments were calculated on a wider regional basis according to figure 3.1. Similarly, there is extensive diversity in the 2014 ARC payments in the other regions featured in table 3.2.

Comparing the individual county ARC payments to the regional average is another way to get an idea of how varied the 2014 corn payments were within the region. For example, the northwest region averaged a payment of 51 dollars per acre. Benton County was the lowest in comparison with a payment of 8 dollars per acre, which is just 16 percent of the county average. Pulaski was one of the counties that reached it maximum payment level of 80 dollars per acre which is 156 percent of the regional average. Likewise, the other regions share this variability. For example, the mid-east region has counties receiving no payments and Blackford County reaching 327 percent of the average weighted payment of 25 dollars per acre. Yield would be the driving factor behind the variability considering prices are held constant across the area.

When compared to Direct Payments, ARC payments show a drastic variance from the fixed decoupled program. In the northeastern region the majority of the 2014 payments were significantly above their respective yearly average support from Direct Payments. However, Benton County received only 28 percent of their respective yearly fixed payment that would have occurred under a continuation of the DP program. The variance around the direct payments illustrates how the ARC program is designed to act as a safety net and distribute support to counties that are affected most from revenue loss. Likewise, the northcentral and mid-east regions are subject to similar discrepancies.

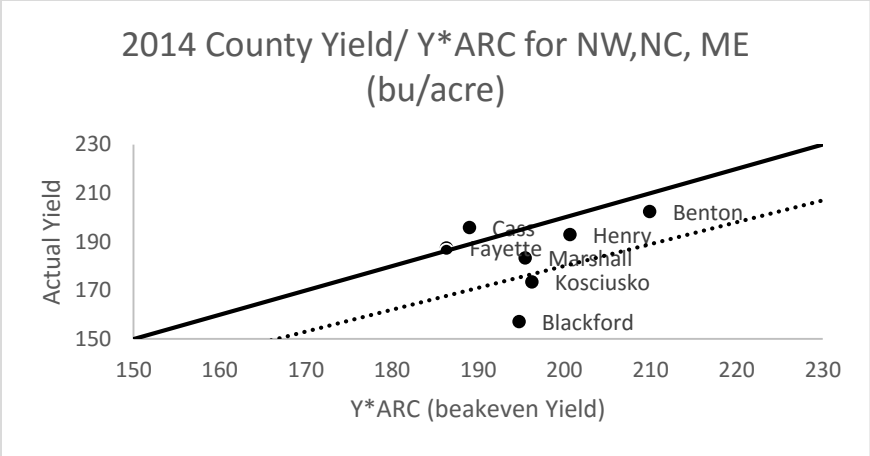

Figure 3. 3 Comparison of Yield Factors for Select Counties in Indiana, 2014 (Source: Author's calculations)

The effect that variance in yields versus their respective Y*ARC on payments received between counties is illustrated in figure 3.3. The figure has pulled three counties from each region that receive no payments, receive non limiting payments, and maximum payments. Figure 3.3 follows the same guidelines as figure 3.2 without the discrepancy of averages. It is clear that wide variety in yields versus their respective Y*ARC across the counties directly influence the level of payments that each county received for 2014. For example, the high yield for Fayette County allowed the county to be above the benchmark and not receive payments. Several counties such as Benton, Henry, Marshall, Koskiusko, and Blackford received payments because of their low yield relative to the Y*ARC threshold yield factor. However, Koskiusko and Blackford counties' yields were low enough to surpass their payment limit revenue deficit. Counties with such large revenue losses could be an issue because they see a lower percentage of support compared to other moderate loss counties. For example, Blackford County's actual yield

is 83 percent of the necessary benchmark, which results in 17 percent loss in revenue that is not made up by ARC.

After the USDA makes the final calculation of payments for the 2014 crop year, it is time to determine the benchmark for 2015. As stated in the background, the olympic average price and yield for the past five years are the main factors in determining the new revenue benchmark. Table 3.3 illustrates the calculation for the 2015 ARC price benchmark of corn.

Table 3. 3 ARC 2015 Benchmark Price (source: author's calculations)

2015 ARC benchmark Price for Corn Calculation ($/bu)

Year	2009	2010	2011	2012	2013	2014	2015 benchmark
U.S. Corn Price	$ 3.55	$ 5.18	$ 6.22	$ 6.89	$ 4.46	$ 3.70	$ 5.29

Beginning with the 2015 crop, the 2009 national price is no longer a factor in the price benchmark calculation. However, it was excluded from the 2014 benchmark price calculations as well because it was the lowest of the five-year price period. This guarantees that the price support of the ARC program via the olympic average price benchmark cannot decline from 2014 to 2015. Because the prices for 2012 and 2014 are the most extreme of the five years, the benchmark price would be the average of years 2010, 2011, and 2013, which is $5.29 per bushel, the same as 2014. Now that the benchmark price is determined, the yield benchmark is the remaining explanatory factor in determining payment qualification in the 2015 crop year.

It is important to note that changing benchmarks could drive payment levels in upward or downward depending on the county's trend in yield. Counties with a large enough yield growth in 2014 to limit ARC payments will necessarily have a stronger

yield protection factor in 2015 ARC calculations. The ARC program's use of olympic moving averages guarantees that in any year you do not receive payments you are adding weight to the overall revenue protection level by causing a relative increase in one of the factors used to calculate future benchmark supports[7]. Using the USDA estimated yields for 2015 crop year we see that only 21 counties will have a different benchmark than 2014 for corn due to changes in the olympic average yield calculations[8]. Of those, only Newton County will have a higher benchmark, and the remaining 20 counties will face a lower benchmark. The effects of the changing benchmarks will be discussed in following sections.

3.5: ARC Corn Outcomes from 2014 to 2015

As stated in the previous section, the ARC price protection component for 2015 is exactly the same as 2014 for corn and soybeans and extremely similar for wheat. Therefore, the variance in 2015 ARC payments on a county or regional basis will be determined by the yield of the county. However, it is important to note that a significant fall in the 2015 national price from 2014 will cause the general payment average to increase evenly across regions for that specific crop.

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[7] Note that this statement while true requires a nuanced definition of protection. The 86 percent factor in the benchmark revenue means that farms could sustain year over year losses and never meet eligibility requirements. Thus, the added policy "weight" should be considered in a relative sense where slower decline relative to other areas is considered in some manner a relative increase in future support or revenue protection.

[8] For many counties the 2014 yield is the highest yield of the most recent five years and is thus omitted in the calculation of the benchmark.

Table 3. 4 ARC Payments from 2014 to 2015 (source: author's calculations)

2014 - 2015 Regional ARC Payments Across Crops ($/acre)

Crop	Region	ARC 2014	ARC 2015	Crop	Region	ARC 2014	ARC 2015	Crop	Region	ARC 2014	ARC 2015
Corn	NW	67	76	Soybeans	NW	2	26	Wheat	NW	0	35
	NC	47	78		NC	0	46		NC	0	31
	NE	22	68		NE	0	37		NE	0	34
	MW	15	71		MW	0	24		MW	0	6
	MC	13	71		MC	0	36		MC	0	13
	ME	39	69		ME	4	33		ME	0	18
	SW	14	56		SW	0	8		SW	0	11
	SC	1	10		SC	0	5		SC	0	4
	SE	0	16		SE	0	17		SE	0	19
	State	26	65		State	1	28		State	0	19

When comparing regional corn payment predictions from the GAMS model for 2015 across Indiana in table 3.4, every region receives ARC support, and the general payment level increases for every region. The relatively consistent payment increase is caused by the decrease in projected prices for 2015; the projected prices used for projections will be discussed in depth within the next section. The 2015 payment variance across regions is not as prominent as 2014 because many of the regions are approaching their respective maximum payment levels. However, the variance is still existent as the south central and southeast regional payments of 10 and 16 dollars per acre are well below the state average of 57 dollars per acre. This would cause the payment distribution to skew to the lower side. A similar payment average and variance story is illustrated when evaluating the 2015 county level payments in table 3.4. The price increase causes the payment level approach the maximum level. The normal payment variance that yield would cause in order to support counties most affected by the change in yield would thus be truncated by the ARC payment limit. Issues caused by the changing benchmarks relative to actual prices and yields could possibly carry on to the following crop years.

Movements of the benchmarks along the life of Agricultural Risk Coverage will be discussed in section 3.5.

After evaluating ARC payments for 2014 and predictions for 2015 we can see a generally large increase in payments as a result in a drop in predicted prices. Moving on to 2016 to 2018 predictions it is important to note the difference in information used for the prediction. 2014 predictions were extremely certain because the USDA has already calculated the payments. There was also plenty of information to aid the accuracy of predictions for 2015. USDA benchmarks were available for the 2015 prediction and the only unknowns were 2015 actual national price and actual yield. However, price benchmarks, yield benchmarks, actual prices, and actual yield are all unknown for the 2016 to 2018 ARC predictions. Methods used to construct the USDA baseline and payment predictions for the ensuing years will be described in the following section.

3.6: Forecasting ARC Outcomes for 2014-2018

Unknown factors such as benchmark and actual prices and yields become an increasing prominent factor toward uncertainty moving past the 2015 ARC predictions. The following section will discuss how the unknown factors could change result. The discussion on how the study dealt with the limited information will be included as well.

One of the largest issues in determining ARC payments for 2016 to 2018 is estimating the prices for these years. Table 3.5 illustrates past prices from 1995 to 2013 and the changes in prices between those years. First, a distributional analysis was performed using @RISK on the annual change in prices. The graph results are available within the appendix. From the analysis of the mean of differences only soybeans was

significantly far from zero. The predicted price change moving into for 2014 was substantially different from what was seen in reality. In addition, there is no evident trend within the price history from visually analyzing table 3.5. For example, the first ten price observations for corn were drastically different than the following years suggesting that the prices were not following a specific trend. In conclusion, it was decided to resort to a baseline approach because there is no clear direction on how to forecast national prices from the time series data.

Table 3. 5 1995 – 2013 Price Behavior (source: NASS)

Corn Prices and Changes from Year to Year ($/bu)

Year	Corn	Corn Change	Soybeans	Soybeans Change	Wheat	Wheat change
1995	$ 3.24		$ 6.72		$ 4.55	
1996	$ 2.71	$ (0.53)	$ 7.35	$ 0.63	$ 4.30	$(0.25)
1997	$ 2.43	$ (0.28)	$ 6.47	$ (0.88)	$ 3.38	$(0.92)
1998	$ 1.94	$ (0.49)	$ 4.93	$ (1.54)	$ 2.65	$(0.73)
1999	$ 1.82	$ (0.12)	$ 4.63	$ (0.30)	$ 2.48	$(0.17)
2000	$ 1.85	$ 0.03	$ 4.54	$ (0.09)	$ 2.62	$ 0.14
2001	$ 1.97	$ 0.12	$ 4.38	$ (0.16)	$ 2.78	$ 0.16
2002	$ 2.32	$ 0.35	$ 5.53	$ 1.15	$ 3.56	$ 0.78
2003	$ 2.42	$ 0.10	$ 7.34	$ 1.81	$ 3.40	$(0.16)
2004	$ 2.06	$ (0.36)	$ 5.74	$ (1.60)	$ 3.40	$ -
2005	$ 2.00	$ (0.06)	$ 5.66	$ (0.08)	$ 3.42	$ 0.02
2006	$ 3.04	$ 1.04	$ 6.43	$ 0.77	$ 4.26	$ 0.84
2007	$ 4.20	$ 1.16	$ 10.10	$ 3.67	$ 6.48	$ 2.22
2008	$ 4.06	$ (0.14)	$ 9.97	$ (0.13)	$ 6.78	$ 0.30
2009	$ 3.55	$ (0.51)	$ 9.59	$ (0.38)	$ 4.87	$(1.91)
2010	$ 5.18	$ 1.63	$ 11.30	$ 1.71	$ 5.70	$ 0.83
2011	$ 6.22	$ 1.04	$ 12.50	$ 1.20	$ 7.24	$ 1.54
2012	$ 6.89	$ 0.67	$ 14.40	$ 1.90	$ 7.77	$ 0.53
2013	$ 4.46	$ (2.43)	$ 13.00	$ (1.40)	$ 6.87	$(0.90)

The best alternative was using the published prices from the USDA's long term agricultural projection (USDA). Projected prices from the USDA were desirable because of their convergence to long term equilibrium. Table 3.6 reveals the prices used to fill in the necessary predicted price benchmarks and actual prices to calculate ARC payments for 2015-2018.

Table 3. 6 USDA Price Forecast (source: Paul 2016)

USDA Crop Price Forcast ($/bu)

Commodity	2014	2015	2016	2017	2018
Corn	$ 3.70	$ 3.65	$ 3.60	$ 3.65	$ 3.70
Soybeans	$ 10.10	$ 8.90	$ 8.65	$ 8.80	$ 8.95
Wheat	$ 5.99	$ 5.00	$ 4.40	$ 4.50	$ 4.60

Determining the yields to use for the ARC payments projections is the next step in completing the calculations needed to determine program payments for 2016 to 2018. A regression analysis was performed in order to obtain reasonable yield estimates for the projection model. Analysis of yield at the county level was first performed in order to determine how yields were trending over time and to see if there was any differences in the trends between counties. However, the results between the counties suggested that each county's yield tend to increase at similar rates when stable estimates could be identified. In many cases, missing values and outlier years confabulated the estimated trend yields though corrections brought them in line.

Due to the similarities in trend yield growth and the likelihood that it is related to technological advance and adoption, we opt to use a common trend coefficient across counties. This offers the particular advantage of maintaining a common predictive factor across counties going forward so that we may continue to simplify county payment predictions using our price and yield factor decomposition. This commonality is important for the out years when projections are required since our interest is partly in understanding how counties that initialized ARC payments in 2014 versus 2015 differ in the remaining years of the program as the ARC benchmark "catches up" to most recent revenue factors was deemed most appropriate because of the similarity. In addition, a

state-wide trend would allow the forecast of yields to be relatively neutral across counties and would not use 92 separate estimates that could potentially report false anomalies and create a yield trend that is unlikely to occur. Another addition to be made is developing an effective yield variance factor to add to the sensitivity of the projections.

After using the estimate prices and yields to forecast the result there are several interesting results to report. The path that ARC trigger yields travel throughout the projection is a rather important factor in determining how ARC payments behave over time. The projected regional average of Y*ARC values are illustrated in table 3.7.

Table 3. 7 Corn Y*ARC Projections for 2014 -2018 (source: author's calculations)

Corn Y*ARC(Benchmark Yield) Projections (bu/acre)

region	2014	2015	2016	2017	2018
NW	198	194	169	140	146
NC	195	194	171	143	146
NE	187	184	160	137	142
MW	202	196	178	150	151
MC	196	192	172	146	149
ME	191	187	166	140	144
SW	191	187	177	147	146
SC	166	161	158	134	132
SE	168	165	159	136	134

The Y*ARC results suggest that the benchmark yields decrease over time. The downward trend of the benchmark is the result of many counties within the region having a low enough revenue to force the olympic average to decrease over time. The downward effect is not initially seen in 2015 because the relatively high benchmark price from 2014

persists until 2016. As stated in previously, high benchmark prices causes the necessary yield to initiate payments to be relatively high. Once the USDA projected prices used in the GAMS model begin to affect the benchmark price in 2016-2018 then the decrease in Y*ARC starts to occur. The decrease in effect would affect the payments farmers receive over time, and this will be discussed in the conclusions.

Table 3. 8 ARC Payments for all Crops and Years (source: author's calculations)

ARC Payments from 2014 to 2018 Across all crops

Crop	Region	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18
Corn	NW	67	76	17	160
	NC	47	78	25	150
	NE	22	68	17	107
	MW	15	71	30	116
	MC	13	71	25	110
	ME	39	69	19	128
	SW	14	56	52	122
	SC	1	10	56	67
	SE	0	16	56	71
	State	26	65	29	120
Soybeans	NW	2	26	16	44
	NC	0	46	13	59
	NE	0	37	17	54
	MW	0	24	19	43
	MC	0	36	11	47
	ME	4	33	13	51
	SW	0	8	31	40
	SC	0	5	41	46
	SE	0	17	30	47
	State	1	28	18	47
Wheat	NW	0	35	35	70
	NC	0	31	37	69
	NE	0	34	38	72
	MW	0	6	55	61
	MC	0	13	54	68
	ME	0	18	44	61
	SW	0	11	43	54
	SC	0	4	55	59
	SE	0	19	54	73
	State	0	19	44	63

Another interesting comparison are the ARC payment results across all of the projected years. As stated in section 3.2, several corn regions did not receive payments in 2014 while others were approaching their maximums. As seen in table 3.8, as the projection progressed the regions that received no or small ARC payments in 2014 began to see payment increases in 2015. The ARC payments for these regions continued to increase until their payments for 2016 to 2018 surpassed the regions that saw the most payments in 2014. The increase seen in these regions is an example of how high yields can drive the revenue benchmark upward in comparison to other regions. For example, table 3.7 shows that the regions that received small payments in 2014 were the ones that also saw an increase in Y*ARC from 2015 to 2016. This larger Y*ARC increase both the benchmark to receive payments but also the maximum payment level as well. Likewise, soybean and wheat producers saw the same effect as many of the regions seeing the majority of their payments after 2015.

A comparison between the payments per acre and revenue per acre can be made to determine an approximate ratio of income support producers are receiving from ARC. Table 3.9 shows the average level of payments for each program throughout the life of the farm bill in comparison to revenue per acre.

The per acre revenues used to create this ratio is derived from the 2016 Purdue Crop Cost and Return Guide at a discounted rate to match the payment estimations (Dobbins et al., 2016). The fact that the guide features revenue estimates with different soil productivity levels allows a better comparison of payments across counties with different production rates. The resulting ratio are produced in table 3.9. The resulting percentage of revenue ARC payment represents ranges from 13 percent for highly

productive soils to 45 percent for the lower. The percentage ranges from 16 percent to 41 percent for soybeans and 9 to 10 percent for wheat going from high to low productive soils.

Table 3. 9 2014-2018 ARC Payment to Revenue Comparison (source: author's calculations)

2014-2018 ARC Payment Percentage of Revenue

Crop	Production Level	Revenue per acre	County payment	Ratio
Corn	high	$210.93	$ 28.41	13%
	mid	$124.60	$ 51.21	41%
	low	$58.74	$ 26.59	45%
Soybeans	high	$138.84	$ 22.28	16%
	mid	$92.56	$ 17.06	18%
	low	$48.06	$ 19.94	41%
Wheat	high	$186.01	$ 16.44	9%
	mid	$ 154.72	$ 15.47	10%
	low	$ 110.38	$ 11.01	10%

A comparison between payment levels and revenue is a good metric to determine the effectiveness of the program at distributing support. However, a comparison against policy alternatives is a preferable metric at determining which program is most viable and will be discussed in the next section.

3.7: Evaluating ARC Performance against Alternatives for 2014 to 2018

Table 3.10 and figure 3.4 shows the comparative level of payments made to each crop across the different region of Indiana. Agricultural Risk Coverage offers the highest rate of support per acre for corn and soybeans when compared to Price Loss Coverage and Direct Payments for duration of the bill. However, PLC offers the most support for Wheat producers.

Table 3. 10 Total Program Payment throughout Term (source: author's calculations)

Total Program Payments for 2014-2018 ($/acre)

Crop	Region	ARC 2014-18	PLC 2014-18	DP 2014-18
Corn	NW	160	36	141
	NC	150	35	139
	NE	107	34	133
	MW	116	36	144
	MC	110	35	140
	ME	128	34	136
	SW	122	34	136
	SC	67	30	118
	SE	71	30	120
	State	120	34	137
Soybeans	NW	44	0	66
	NC	59	0	68
	NE	54	0	67
	MW	43	0	68
	MC	47	0	70
	ME	51	0	68
	SW	40	0	62
	SC	46	0	55
	SE	47	0	58
	State	47	0	66
Wheat	NW	70	196	112
	NC	69	194	111
	NE	72	194	111
	MW	61	175	100
	MC	68	197	113
	ME	61	189	108
	SW	54	174	100
	SC	59	158	90
	SE	73	175	100
	State	63	184	105

ARC offers effective price support protection for corn producers because the benchmark price was so high compared to the actual price in the initial year (Keeney et al., 2014). This large difference allowed the program to maintain a high benchmark until the high prices were rotated out of the calculation mix. For example, the price difference was so vast in the 2014 calculation that yield had a 29 percent buffer before payments would not be administered. This wide gap allowed the general level of ARC payments to approach maximum payments for many regions and many counties to exceed the cap in 2014.

Soybeans also featured ARC as their leading income supporter for similar reasons as corn, but an interesting feature is that they received no PLC payments for the duration of the program. The relatively low reference price of 8.40 dollars per bushel for PLC for soybeans is the driving factor behind the nonexistent payments because the minimum USDA projection is 8.65 dollars per bushel. The relative proximity of payments between ARC and DP for soybeans is also interesting because of the fixed nature or DP. For example the stability of DP could cause some risk averse producers to still favor that program for soybeans.

Wheat is the exception of the crops because PLC is the largest income support program for the commodity. The payment level can be explained by the large drop below the PLC reference price by the USDA price projections causing the PLC payments to exceed the 10 percent ARC payment cap. This an interesting example of how target prices have a large effect on payment rates between programs.

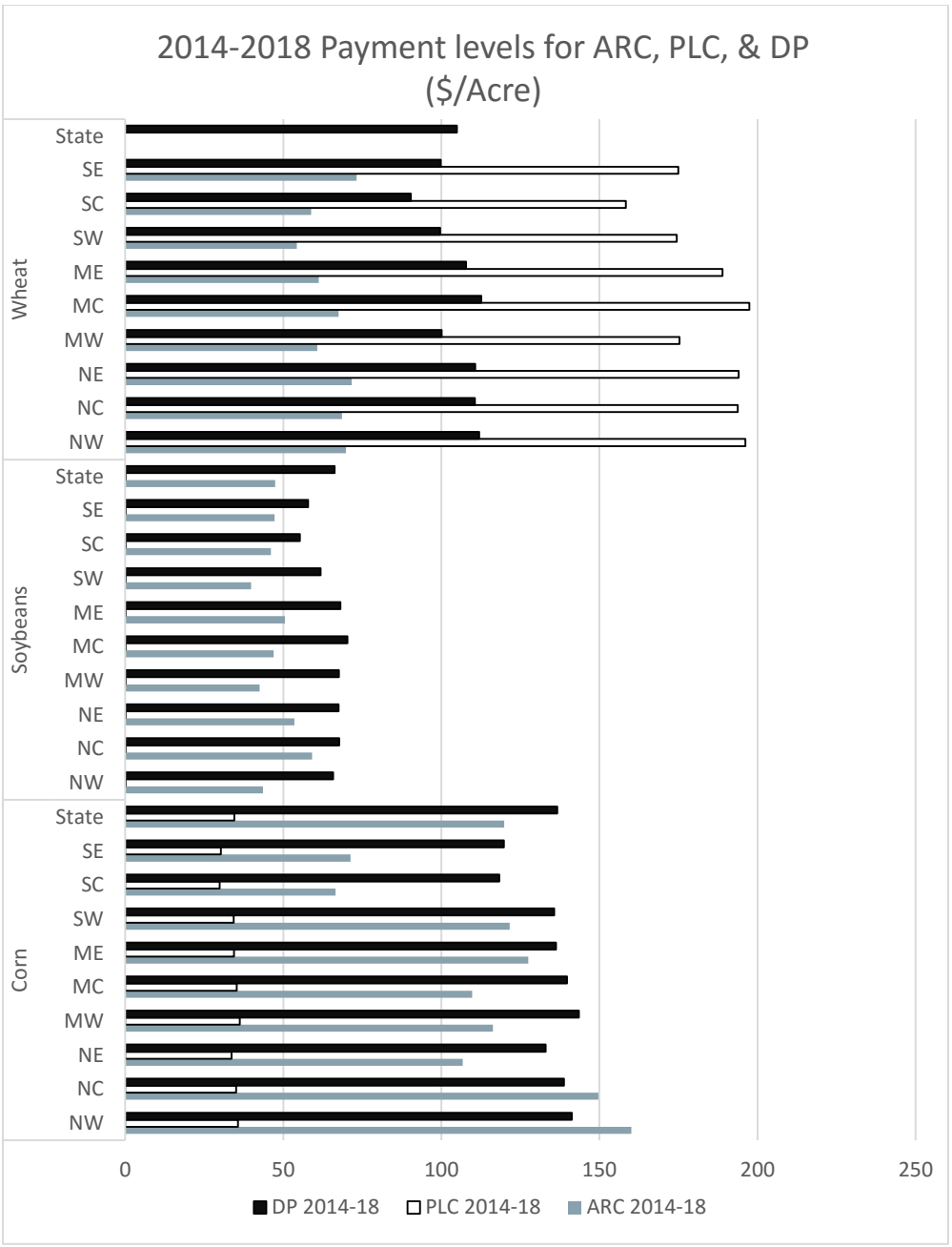

Figure 3. 4 Program Payment Level Comparison (source: author's calculations)

3.8: 2014 Commodity Program Mix Performance

The purpose of the analysis is to evaluate the 2014 Farm Bill commodity programs in reducing farm subsidy spending, and the effectiveness of distributed payments. In terms of spending on commodity programs in Indiana, Agricultural Risk Coverage and Price Loss Coverage surpass the payment levels of Direct Payments within many regions of the state. Therefore, the 2014 Farm Bill can be expected not to accomplish the goal of reducing farm subsidies. However, a more in depth analysis would have to be done to include reductions in conservation and other program spending, and a sensitivity or variance aspect would need to be added to strengthen the conclusion.

In terms of distributing the payments, ARC effectively distributes payments to the counties most effected by revenue loss through the varying levels of support across counties. ARC's ability to vary payments between counties is an advantage over DP, which distributes payments regardless of each counties losses. PLC is effective at compensating producers who face deep price losses as seen in the wheat payment projections. PLC's ability to respond to prices give it a competitive advantage over DP, which would fail to increase support in the event of a collapse in prices. In conclusion, ARC allows farmers in counties that suffer greater loss than average would be better off than with DP, but counties that perform above normal would not. For example, table 3.11 extracts counties that show both scenarios for corn and soybeans. Similarly, PLC benefits entire commodity producers who face a deep price deficit more than with DP, such as the case for all wheat counties.

Table 3. 11 Payment Diversity Example (source: author's calculations)

2014-2018 Program Payment Comparison

Crop	Counties	ARC 2014-18	PLC 2014-18	DP 2014-18
corn	Jasper	183	35	140
	Wells	134	36	141
	Clinton	160	40	157
Soybeans	Jasper	97	0	67
	Benton	49	0	70
	Clay	59	0	60

However, the conclusions made are excluding the influence of risk preference among farmer's program decisions. The effect that risk would have on farmer's preference between ARC and DP is prevalent in certain counties where the difference in payments are insignificant such as Clinton and Clay counties. However, the majority of counties for corn and wheat skew too heavily towards ARC and PLC for risk to have large effect. Soybean producers would be the group that would be most influenced by risk aversion because of the similarity of ARC and DP payments.

3.9 Policy Implications

The results from chapter 3 reveal many policy implications throughout the five dimensions mentioned in the beginning of the chapter. The following chapter will draw conclusions for each dimension based off of the baseline deterministic results as a basis of what to be expected in the future given that the long run equilibrium holds.

In terms of the first two dimensions, crop and program, we can conclude from table 3.10 that corn receives the largest portion of ARC payments and wheat receives the largest portion of PLC and overall support. Soybeans receives the lowest level of income support from all three programs. In comparison to the control, Direct Payments, the 2014

farm bill programs offer varying preferable support for corn based on the performance of the region. The payments variability indicates that the programs are working as a safety net or insurance program. Soybeans receives lower support from the 2014 programs than the control, which indicates that ARC and PLC are acting as safety nets but would be unfavorable to those producers depending on their risk behavior. However, wheat receives more support that the control and most of the support comes from PLC. This shows that the price protection from PLC was great enough for the safety net to overcome direct payments.

Moving on to the third dimension, geography, there is a great amount of payment variability from county to county that could cause producers to see the program as unfair. Figure 3.3 illustrates how geographical differences in yield performances affects payment levels. For example, producers for Cass and Fayette County could view the ARC program as unfair because they received no support even though they saw the same prices as Henry and Benton. Blackford producers could see ARC as unfair because they suffered greater percentage losses than Kosciusko, but received the same level of payment. As previously stated in the introduction of chapter 3, the geographical differences in yield across the state of Indiana and other similar states is the driving factor in the varying level of ARC support in any given year. The differences in historical and current soil performance is the main reason the south central and southeastern regions received such little support in 2014.

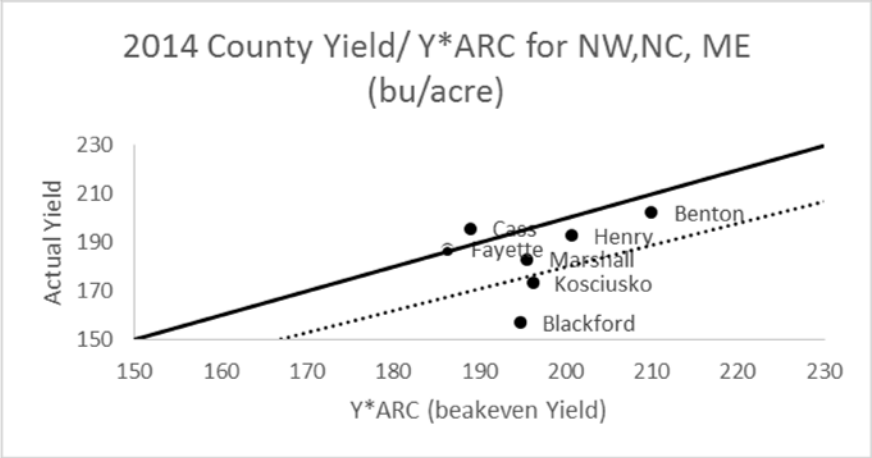

Figure 3. 3 Comparison of Yield Factors for Select Counties in Indiana, 2014 (Source: author's calculations)

Figures 3.5, 3.6, and 3.7 illustrate the relationship between the average price, ARC benchmark price, and the PLC reference price for corn, soybeans, and wheat. From the graphs, some of the results from the payments projection begin to make sense. For example, for 2014 corn received the majority of indemnity payments for ARC, and corn also has the greatest gap between actual price and benchmark price. Then as time progresses, soybeans and wheat begin to see support as their gaps begin to widen, and they begin to receive ARC support. The graph also show why ARC was so preferable to PLC for corn and soybeans. The olympic average that ARC uses to calculate benchmarks allows the price benchmark to stay relatively high after the 2009 to 2013 price peaks and does not begin to approach the PLC rate until the latter years of the bill. However, the ARC benchmark does actually fall below the PLC rate for wheat, which explains why wheat received more PLC support than ARC and why there was PLC signup interest from wheat producers.

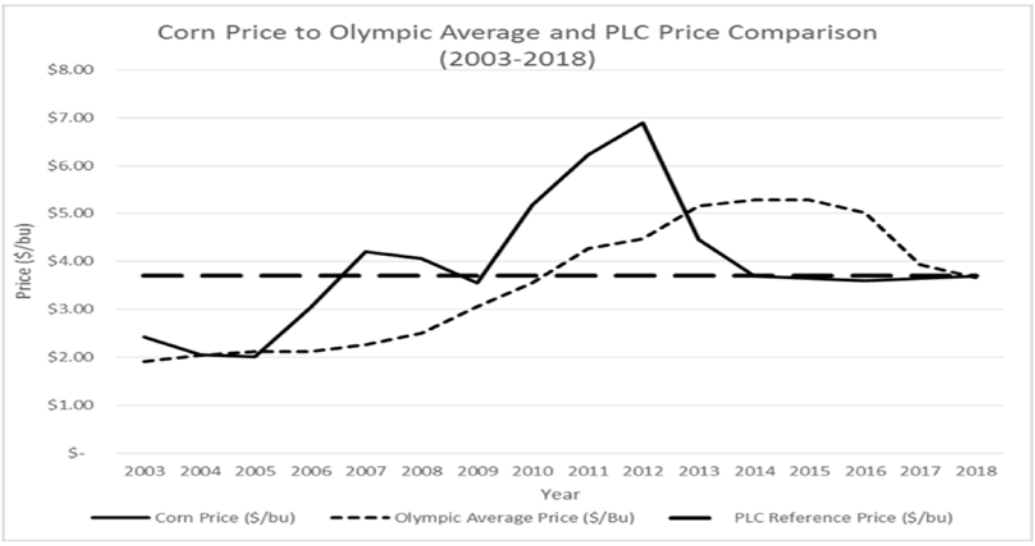

Figure 3. 5 Corn Price Comparison (2003-2018) (source: USDA)

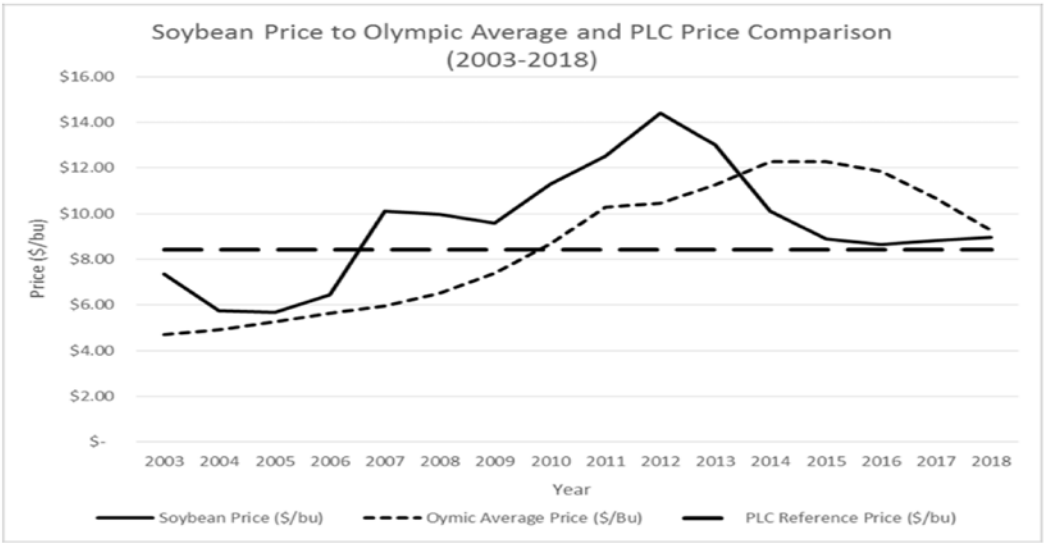

Figure 3. 6 Soybeans Price Comparison (2003-2018) (source: USDA)

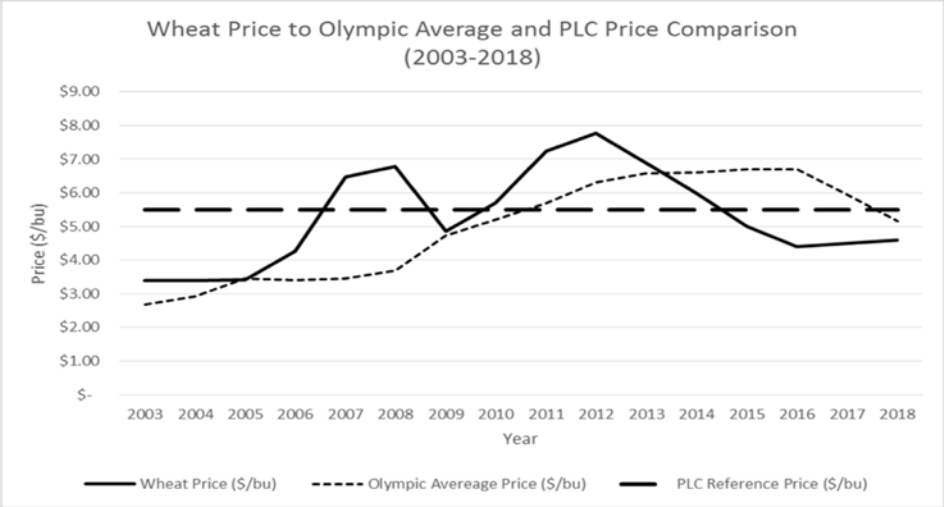

Figure 3. 7 Wheat Price Comparison (2003-2018) (source: USDA)

Figures 3.8, 3.9, and 3.10 show the relationship that price shares with the last dimension, time. As stated previously the "memory" aspect of the ARC benchmark olympic average creates an interesting aspect of the ARC program. For example, as the high prices of 2009 to 2013 are phased out of the calculation, the benchmark then starts to decrease as seen in the years after 2016. The decreasing benchmark thus decreases the level of price protection seen by producers given that the long run equilibrium holds. This phenomena suggests that ARC could potentially reduce its level of price protection in times of continually low prices, which would be a time that producers would need the support the most. Figures 3.8, 3.9, and 3.10, reveal the relationship of geography and time. The 2014 and 2015 graph show how payments react after going from a year with high yields towards a normal year. Payment levels shift upwards along the payment curve and many counties have the opportunity to catch up on the years of high ARC price protection which ends after 2015. After 2015, the overall payment levels decrease and

shift down the curve as price protection decreases, but the geographic variability in yields allows many counties to receive support.

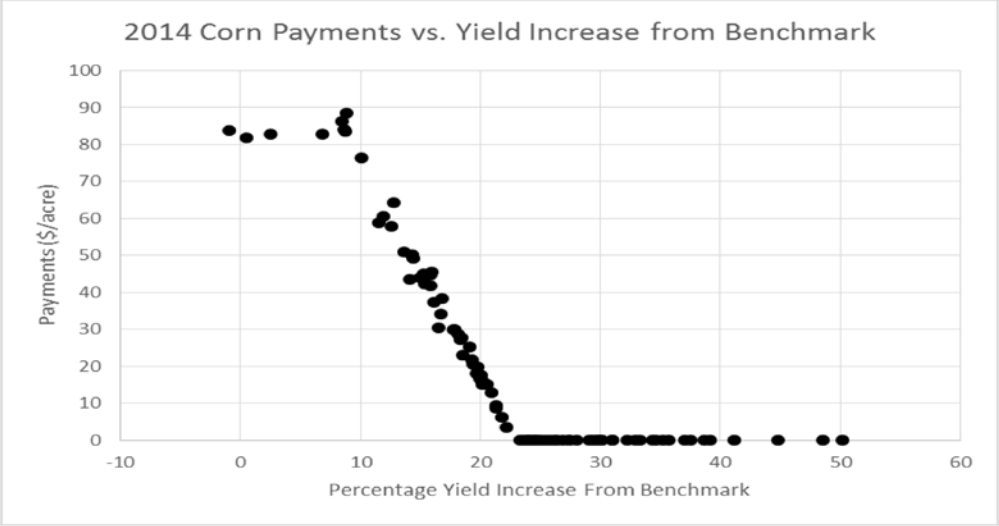

Figure 3. 8 2014 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

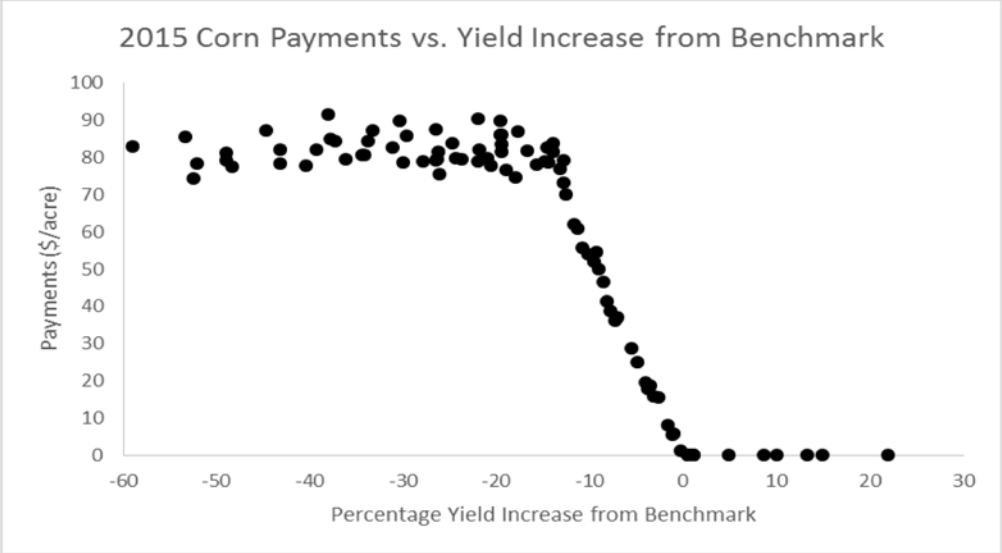

Figure 3. 9 2015 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

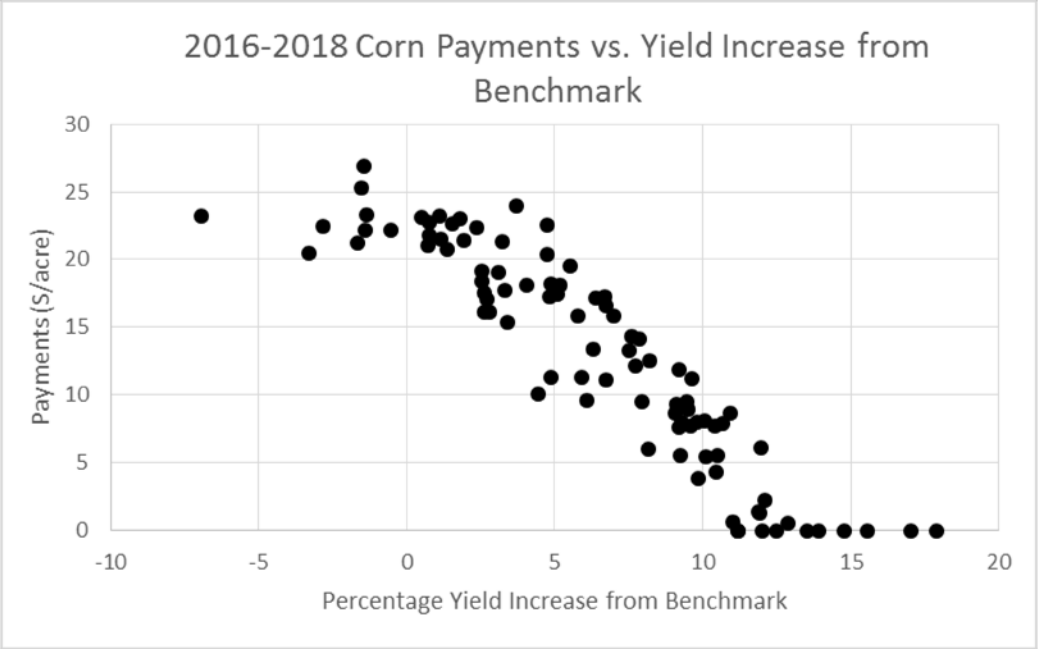

Figure 3. 10 2016-2018 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

Table 3.7 illustrates how the regional Y*ARC's will react over time. There is a similar trend to what is seen in prices in that the overall Y*ARC level decreases after 2015. The falling Y*ARC can be seen as a lowering yield protection level across the state. When combined with the lowering price protection, the affect could significantly reduce revenue protection levels as well. The falling payment levels could cause the lobbying for emergency support if the long run equilibrium failed to a more dismal outcome.

Table 3. 7 Corn Y*ARC Projections for all Crops and Years (source: author's calculations)

Corn Y*ARC(Benchmark Yield) Projections (bu/acre)

region	2014	2015	2016	2017	2018
NW	198	194	169	140	146
NC	195	194	171	143	146
NE	187	184	160	137	142
MW	202	196	178	150	151
MC	196	192	172	146	149
ME	191	187	166	140	144
SW	191	187	177	147	146
SC	166	161	158	134	132
SE	168	165	159	136	134

After evaluating the results across the five dimensions of the study, a grasp on the potential policy implications of the 2014 Farm Bill can be attained. The geographical implications of ARC could result in lower yielding counties not receiving support in time of high yield growth even though their revenue is still not comparable to higher yielding areas that did receive support. In addition, the price protection relationship between ARC and PLC could pose as a source of dissatisfaction as wheat producers mainly elected into ARC even though PLC could be the most rewarding program. Finally in times of continually low prices and steady yields, the moving average used to calculate the ARC benchmark could potentially drive support levels down enough to where additional support is needed. In conclusion, the 2014 programs have many characteristics that could prove to be problematic in the future.

CHAPTER 4: AFTERWORD

4.1: Price and Yield Behavior Conclusions

From the results section, it is clear that Agricultural Risk Coverage county payments are extremely dependent on the price and yield behavior of a specific county. In addition, the starting point of the ARC benchmarks are a major contributor to the variance of payments between PLC and ARC payment levels, entire crop ARC payment levels, and even between county ARC payments as well. Throughout the payment results, interesting conclusions can be derived by the effect prices and yields have on the way ARC distributes payments to the counties

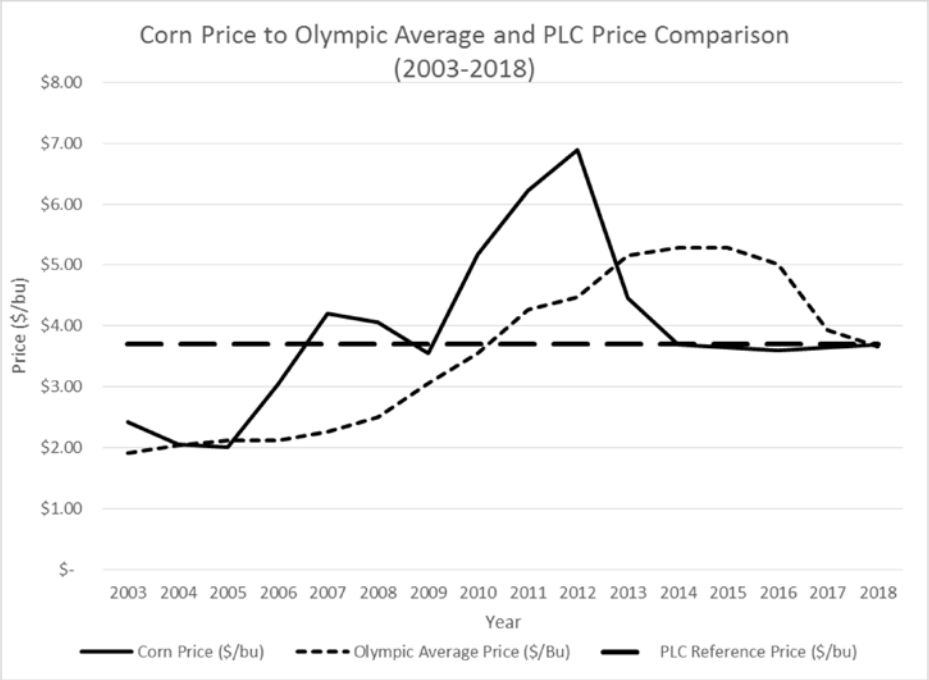

Figure 4.1 Corn Price Comparison (2003-2018) (source: USDA)

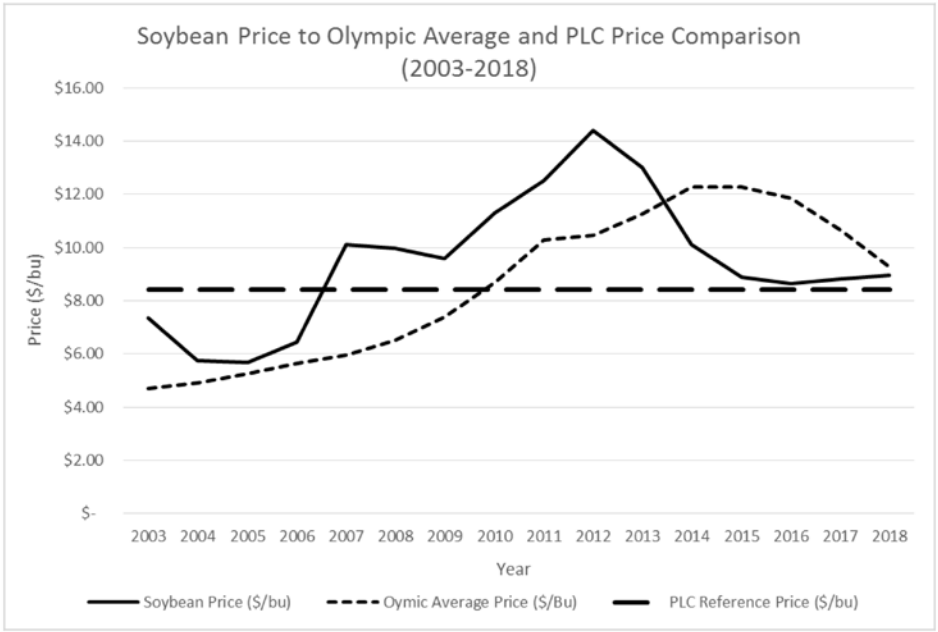

Figure 4.2 Soybeans Price Comparison (2003-2018) (source: USDA)

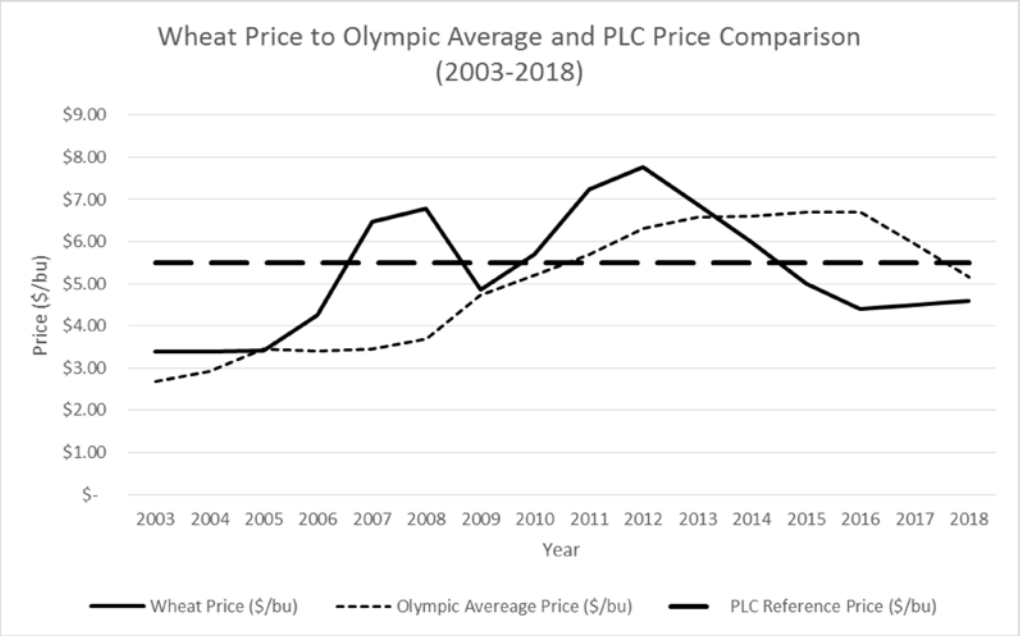

Figure 4.3 Wheat Price Comparison (2003-2018) (source: USDA)

Figures 4.1, 4.2, and 4.3 illustrate the relationship that prices have to the ARC and PLC payments. The figures reveal how corn's high initial benchmark, from unusually high prices in the 2009 to 2013 period, caused such high payments relative to soybeans and wheat. As stated previously, the percentage price discrepancy between the actual corn price and benchmark was 43 percent while soybeans and wheat were just 18 and 10 percent respectively. The differences between the benchmark and actual prices allowed corn to have a larger deficit for yields to overcome to not receive payments than soybeans and wheat. This shows the importance of the starting point in the ARC program are to the price protection aspect of the program.

When comparing olympic average prices towards the PLC reference prices, it is understandable as to why PLC was more attractive to wheat producers. For example, soybeans never received payments from PLC in the projections because the soybean price

never fell below the PLC reference. However, Wheat descended below the reference in 2015 and stayed there for the duration of the projections, which resulted in the high PLC payments for wheat. In terms of total price protection ARC has the advantage over PLC for corn and soybeans but not for wheat. This could also be an explanation to why PLC was attractive to wheat producers during program sign up.

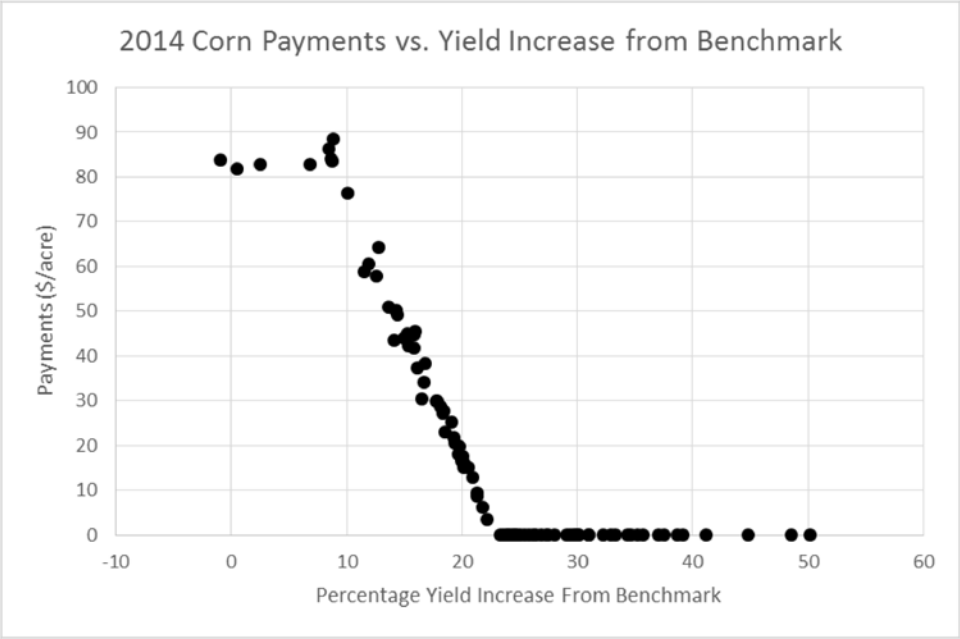

Figure 4.4 2014 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

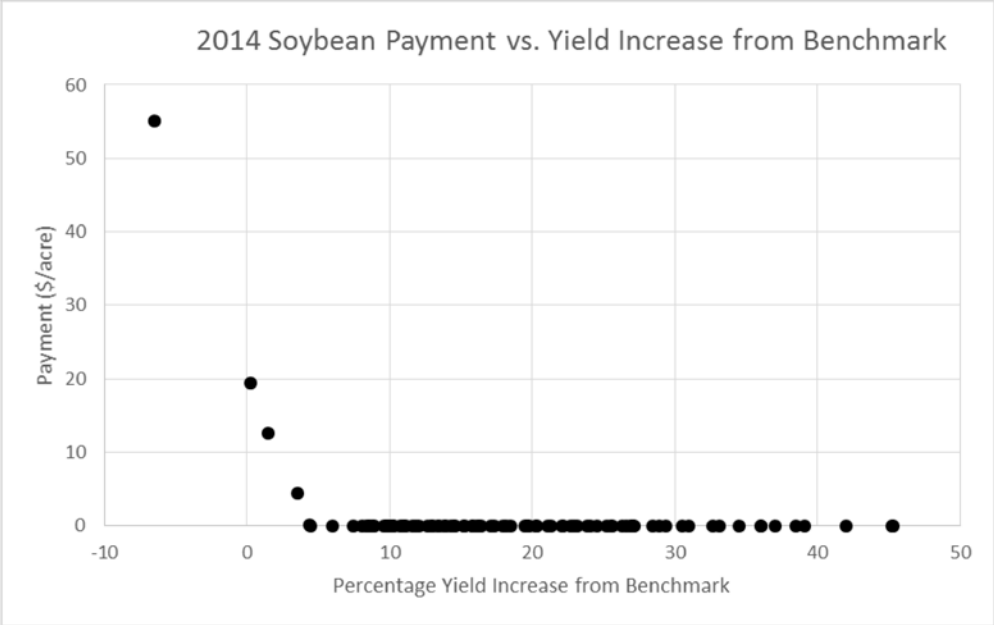

Figure 4. 5 2014 Soybean Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

It is easy to see the payment patterns across the counties of Indiana when judging the affect that yield has on the ARC payment results. Figures 3.8 and 4.1 show the relationship between the 2014 ARC corn and soybean payments on the y-axis and percent yield increase on x-axis. The graph effectively illustrates how the level of payments decreases linearly as the percent increase in yield from the benchmark increases. This

could be the reason responsible for only 4 out of 9 regions accumulating the majority of ARC support for corn in 2014. It is also the reason why only one county generated payments for soybeans even though the actual price was 4 percent below the benchmark.

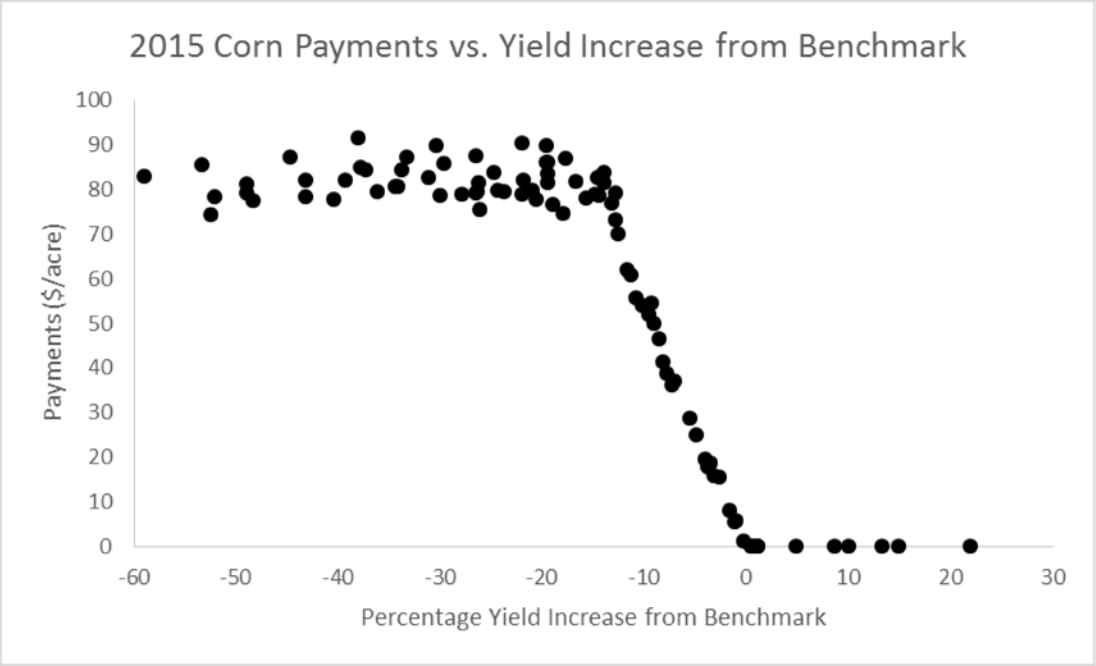

Figure 4.6 2015 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

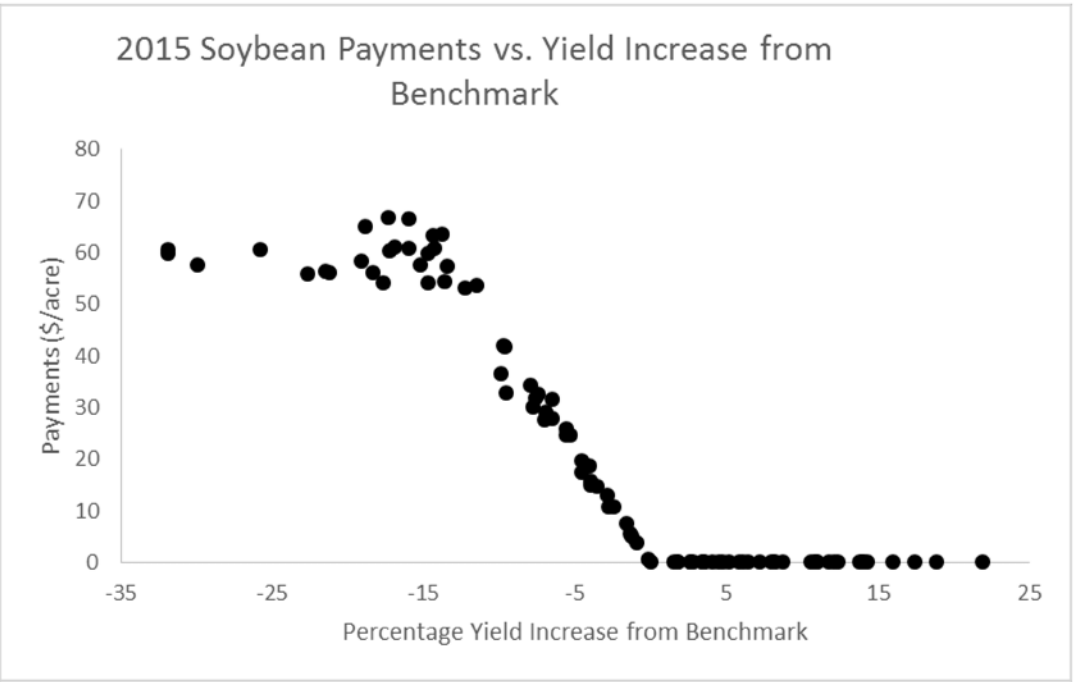

Figure 4. 7 2015 Soybean Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

Moving on to the 2015 figures, 4.6 and 4.7, the yield declines begin to increase the payment structure for soybeans, but tell a similar story as the as the 2014 figures. This shows how the strong yields from 2014 forced the overall ARC payment levels downward, but the payments began to be generated for counties that received no payments in 2014 as 2015 yields normalized and prices continued to fall. However, even though the counties that received no payments in 2014 are given the opportunity to catch up in support, they still missed out on half of the years of the highest price support as the benchmark begins to fall in 2016. Therefore, the effect yield has on ARC payments plays a major role in the level of support between counties.

4.2: 2014 Farm Bill on Farm Support and Spending

In the analysis between the effectiveness in farm support of ARC and PLC, the comparison is made to previous Direct Payments as if the program had continued. This comparison would be the best measure of the program's effectiveness of distributing income support. The ratio of ARC and PLC payments to DP is a good measure of ARC's and PLC's effectively distributes more payments to those facing larger losses since DP is fixed regardless of conditions and ARC and PLC varies depending on economic conditions. For corn ARC's ratio to DP is the best measure since ARC makes up the vast majority of base acres. The ratio varies from 111 percent to 145 percent of DP. The high ratio could be the result in the projected drop in prices from 2014 to 2018, but the variability in the levels of support suggest that ARC is more efficient at distributing payment where it is needed. Soybeans shows a very similar result ranging from 111 percent to 142 percent of DP. Wheat however, does not show that variance with a ratio ranging from 78 to 89 percent, however most of its support comes from PLC which has a steady rate of 175 percent of DP. This large ration shows how the price drop results in a larger support rate from PLC rather than a steady rate from DP. In conclusion, ARC and PLC are more effective at serving as a safety net that DP. However, even though the payments from ARC are larger in times of hardship than DP, the ARC payments are not received until well after a year from harvest. This leaves the producer to incur that cost until they receive the payment. The untimeliness of payment alongside the risk aversion

value created by DP could cause some producers to still prefer DP based on their utility of risk and time.

In terms of spending, evidence from the payment result suggest an increase in commodity spending in the future. Since payment levels will be driven up by the expected drop in prices, ARC and PLC programs will surpass the levels of direct payments. The USDA also expects an increase in commodity spending to go with the conclusions drawn from the projections (ERS, 2016).

4.3: Recommendations for Future Research

After the conclusion of the study, there are some recommendations to be made going forward. First, a sensitivity analysis or an addition of a variance aspect to the yield affect generated by ARC should be conducted to get a more in depth insight to how this would affect counties differently. In addition, the aspect that risk aversion could have on the preference between ARC and PLC versus fixed programs like DP would be an interesting question to answer and would draw interest when considering policy options in the future. Testing how ARC and PLC behaved outside of the subjective conditions generated during the 2014 to 2018 time frame would offer a better grasp on how the programs would behave under average conditions.

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APPENDIX

APPENDIX

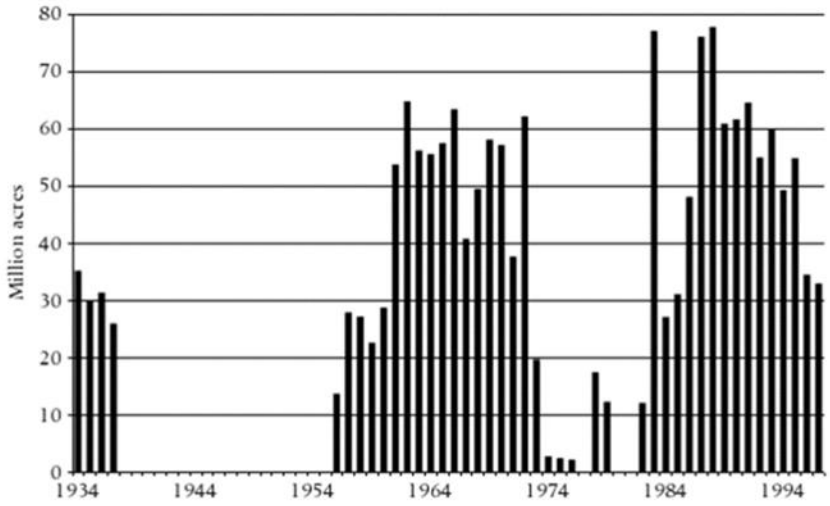

Figure 2. 1 Figure 2. 2 History of Acreage Idled in US production (source Bruce Gardner's: American Agriculture in the Twentieth Century)

Figure 2. 2 Value of government inventories (source Bruce Gardner's: American Agriculture in the Twentieth Century)

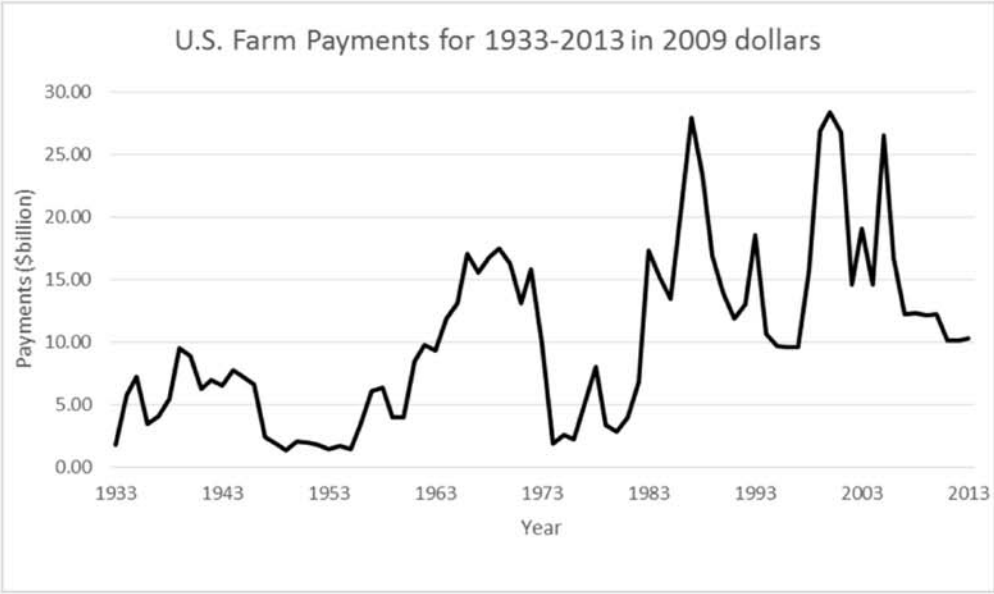

Figure 2. 3 American Farm Support Payments from 1933-2013

Table 2. 4 Indiana and neighboring states' signup for 2014 farm bill programs (Source: Farm Service Agency)

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Indiana	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres3**	**Farm Count4**	**Base Acres5**
CORN	2374	144860.09	104844	6570383.89	34	2905.84
SOYBEANS	1951	70743.34	93335	3675233.79	32	1477.29
WHEAT	2100	36351.41	33660	429897.47	16	158.77
CORN	2.21%	2.16%	97.75%	97.80%	0.03%	0.04%
SOYBEANS	2.05%	1.89%	97.92%	98.07%	0.03%	0.04%
WHEAT	5.87%	7.79%	94.09%	92.17%	0.04%	0.03%

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Illinois	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres3**	**Farm Count4**	**Base Acres5**
CORN	3951	257719.52	159556	12936089.08	216	21583.33
SOYBEANS	3255	161236.79	140474	6964923.98	188	11086.82
WHEAT	11125	305176.58	36338	561221.32	32	359.25
CORN	2.41%	1.95%	97.45%	97.89%	0.13%	0.16%
SOYBEANS	2.26%	2.26%	97.61%	97.59%	0.13%	0.16%
WHEAT	23.42%	35.21%	76.51%	64.75%	0.07%	0.04%

Covered Commodity	Price Loss Coverage (PLC)		Agriculture Risk Coverage-County Option (ARC-CO)		Agriculture Risk Coverage-Individual Option (ARC-IC)	
Ohio	**Farm Count**	**Base Acres**	**Farm Count2**	**Base Acres2**	**Farm Count3**	**Base Acres3**
CORN	2084	81180.56	89448	4073101.69	121	7497.37
SOYBEANS	2100	79923.85	80534	3116075.67	112	5495.21
WHEAT	7246	147311.38	43055	690446.7	77	1958.73
CORN	2.27%	1.95%	97.59%	97.87%	0.13%	0.18%
SOYBEANS	2.54%	2.50%	97.33%	97.33%	0.14%	0.17%
WHEAT	14.38%	17.54%	85.46%	82.22%	0.15%	0.23%

Table 2. 5 Comparison of 2014 commodity program features (Source: Farm Service Agency)

Program feature comparison

Atribute	Agricultural Risk Coverage: County	Agricultural Risk Coverage: Individual Option	Price Loss Coverage
Payment Triggers	86 percent of average county per acre revenue	86 percent of average farm per acre revenue	Price levels
Pay Basis	County basis	Farm basis	Program basis
Constant or moving average for calculation	5-year olympic Average	5-year olympic Average	Constant price floor
Payment Acreage	85 percent of base acres	65 percent of base acres	85 percent of base acres
Payment Cap	10%	10%	No cap

Table 2. 6 PLC reference prices in the 2014 farm bill for select crops (Source: FSA)

Crop PLC Reference Prices

	Corn	Soybeans	Wheat
Benchmark Price ($/bu)	$ 3.70	$ 8.40	$ 5.50

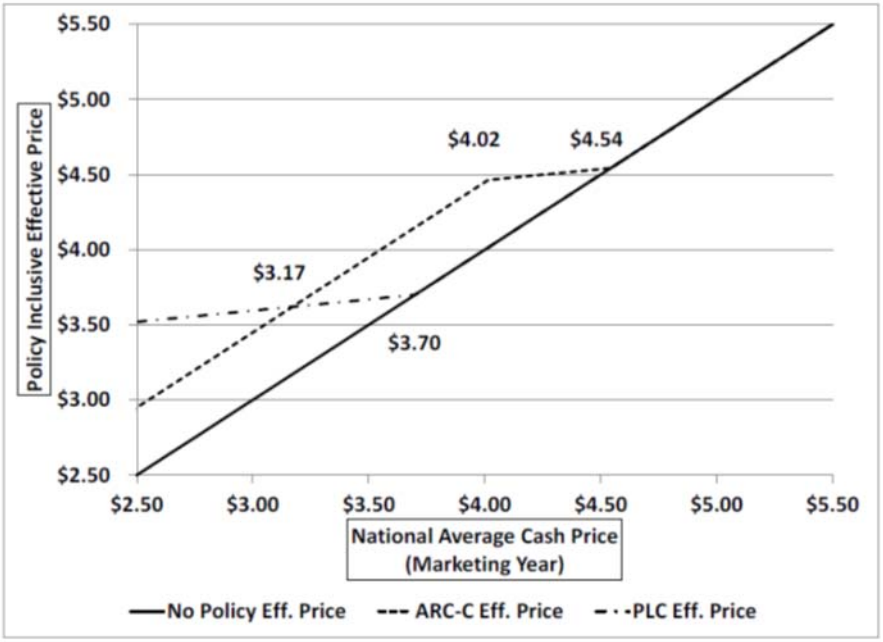

Figure 3. 1 ARC/PLC payments outcomes given a 4 percent yield increase (source: Keeney)

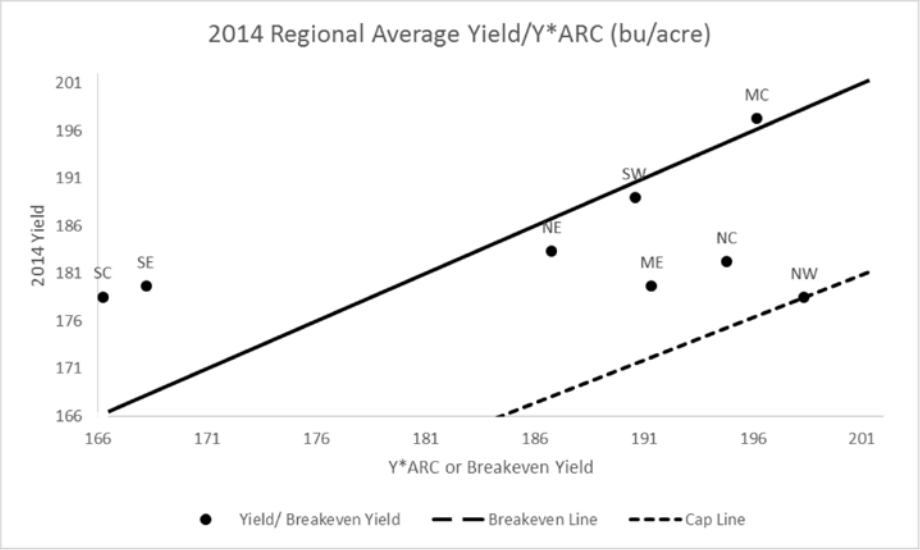

Figure 3. 2 Crop reporting district payment aggregates under the ARC program for 2014 (Source: Author's calculations)

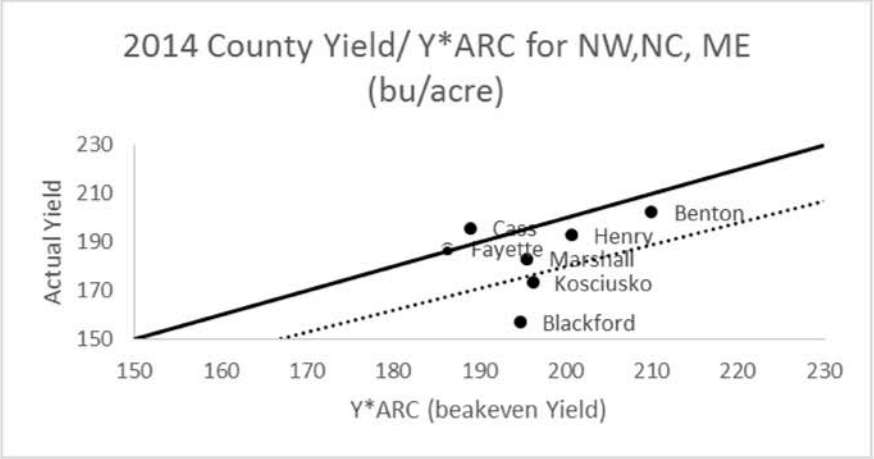

Figure 3. 3 Comparison of yield factors for select counties in Indiana, 2014 (Source: Author's calculations)

Table 3. 9 ARC 2015 Benchmark Price (source: author's calculations)

2015 ARC benchmark Price for Corn Calculation ($/bu)

Year	2009	2010	2011	2012	2013	2014	2015 benchmark
U.S. Corn Price	$ 3.55	$ 5.18	$ 6.22	$ 6.89	$ 4.46	$ 3.70	$ 5.29

Table 3. 10 1995 – 2013 Price Behavior (source: NASS)

Corn Prices and Changes from Year to Year ($/bu)

Year	Corn	Corn Change	Soybeans	Soybeans Change	Wheat	Wheat change
1995	$ 3.24		$ 6.72		$ 4.55	
1996	$ 2.71	$ (0.53)	$ 7.35	$ 0.63	$ 4.30	$(0.25)
1997	$ 2.43	$ (0.28)	$ 6.47	$ (0.88)	$ 3.38	$(0.92)
1998	$ 1.94	$ (0.49)	$ 4.93	$ (1.54)	$ 2.65	$(0.73)
1999	$ 1.82	$ (0.12)	$ 4.63	$ (0.30)	$ 2.48	$(0.17)
2000	$ 1.85	$ 0.03	$ 4.54	$ (0.09)	$ 2.62	$ 0.14
2001	$ 1.97	$ 0.12	$ 4.38	$ (0.16)	$ 2.78	$ 0.16
2002	$ 2.32	$ 0.35	$ 5.53	$ 1.15	$ 3.56	$ 0.78
2003	$ 2.42	$ 0.10	$ 7.34	$ 1.81	$ 3.40	$(0.16)
2004	$ 2.06	$ (0.36)	$ 5.74	$ (1.60)	$ 3.40	$ -
2005	$ 2.00	$ (0.06)	$ 5.66	$ (0.08)	$ 3.42	$ 0.02
2006	$ 3.04	$ 1.04	$ 6.43	$ 0.77	$ 4.26	$ 0.84
2007	$ 4.20	$ 1.16	$ 10.10	$ 3.67	$ 6.48	$ 2.22
2008	$ 4.06	$ (0.14)	$ 9.97	$ (0.13)	$ 6.78	$ 0.30
2009	$ 3.55	$ (0.51)	$ 9.59	$ (0.38)	$ 4.87	$(1.91)
2010	$ 5.18	$ 1.63	$ 11.30	$ 1.71	$ 5.70	$ 0.83
2011	$ 6.22	$ 1.04	$ 12.50	$ 1.20	$ 7.24	$ 1.54
2012	$ 6.89	$ 0.67	$ 14.40	$ 1.90	$ 7.77	$ 0.53
2013	$ 4.46	$ (2.43)	$ 13.00	$ (1.40)	$ 6.87	$(0.90)

Table 3. 11 USDA Price Forecast (source: Paul 2016)

USDA Crop Price Forcast ($/bu)

Commodity	2014	2015	2016	2017	2018
Corn	$ 3.70	$ 3.65	$ 3.60	$ 3.65	$ 3.70
Soybeans	$ 10.10	$ 8.90	$ 8.65	$ 8.80	$ 8.95
Wheat	$ 5.99	$ 5.00	$ 4.40	$ 4.50	$ 4.60

Table 3. 12 Corn Y*ARC projections for 2014 -2018 (source: author's calculations)

Corn Y*ARC(Benchmark Yield) Projections (bu/acre)

region	2014	2015	2016	2017	2018
NW	198	194	169	140	146
NC	195	194	171	143	146
NE	187	184	160	137	142
MW	202	196	178	150	151
MC	196	192	172	146	149
ME	191	187	166	140	144
SW	191	187	177	147	146
SC	166	161	158	134	132
SE	168	165	159	136	134

Table 3. 13 2014-2018 ARC Payment to Revenue Comparison (source: author's calculations)

2014-2018 ARC Payment Percentage of Revenue

Crop	Production Level	Revenue per acre	County payment	Ratio
Corn	high	$210.93	$ 28.41	13%
	mid	$124.60	$ 51.21	41%
	low	$58.74	$ 26.59	45%
Soybeans	high	$138.84	$ 22.28	16%
	mid	$92.56	$ 17.06	18%
	low	$48.06	$ 19.94	41%
Wheat	high	$186.01	$ 16.44	9%
	mid	$ 154.72	$ 15.47	10%
	low	$ 110.38	$ 11.01	10%

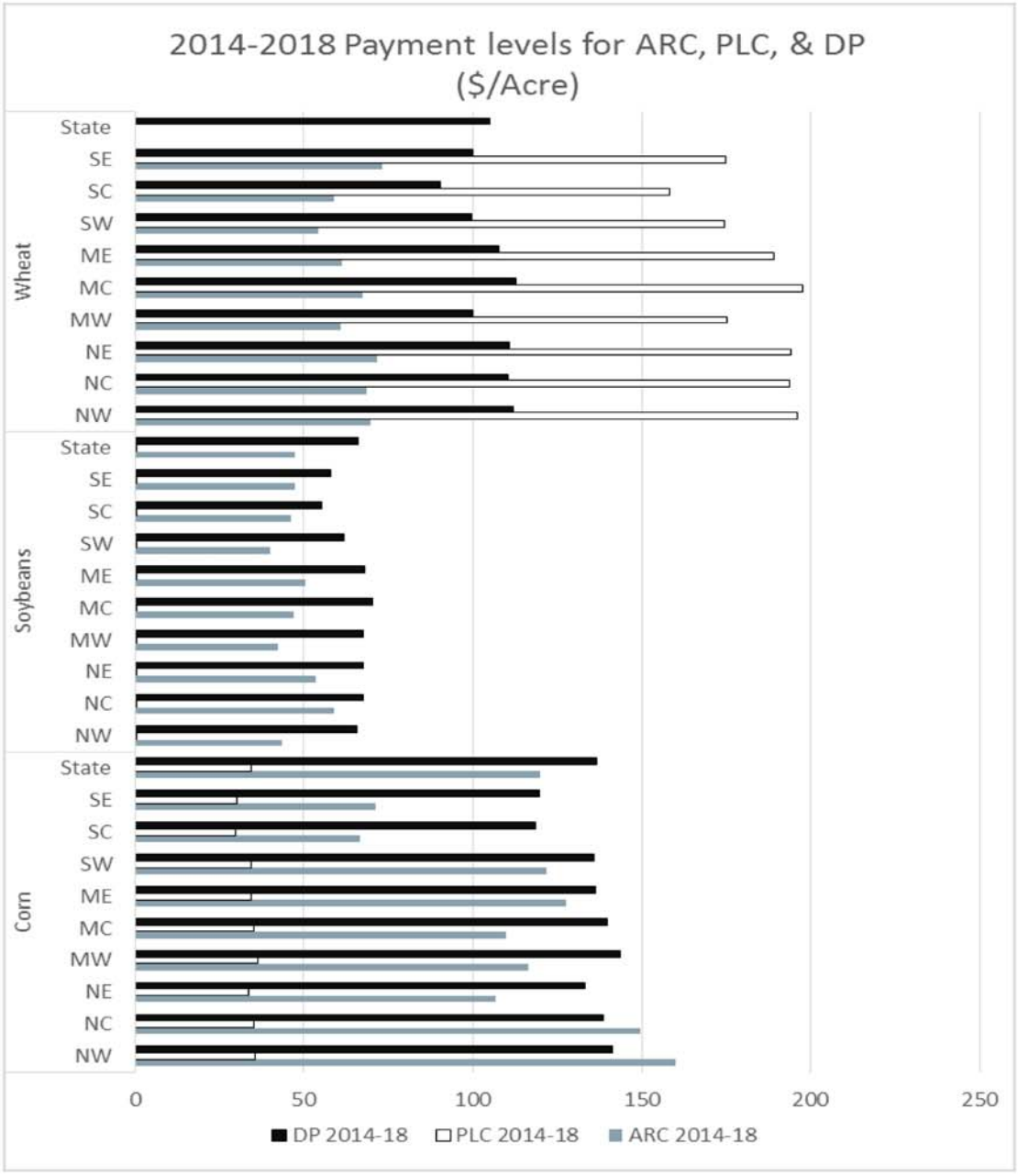

Figure 3. 4 Program Payment Level Comparison (source: author's calculations)

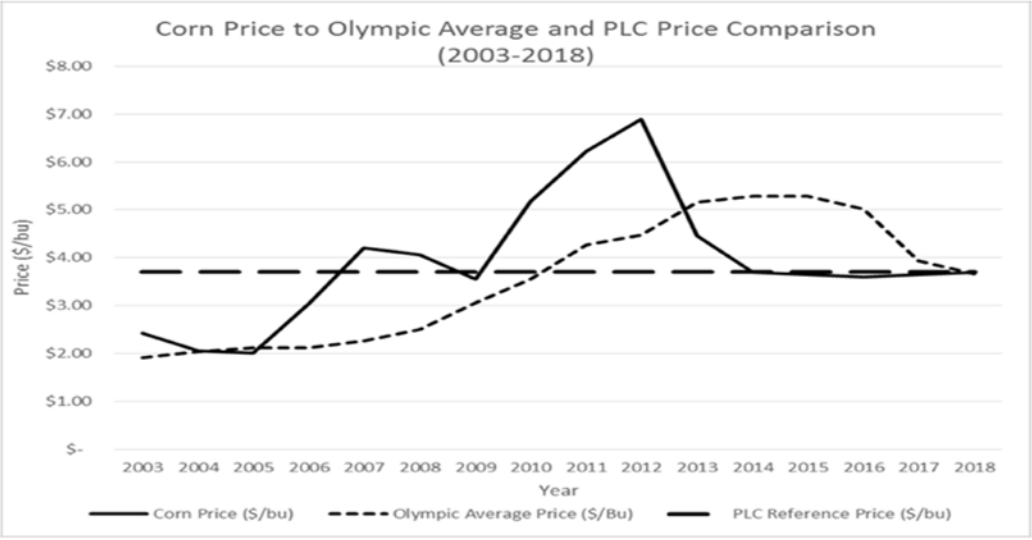

Figure 3. 3 Corn Price Comparison (2003-2018) (source: USDA)

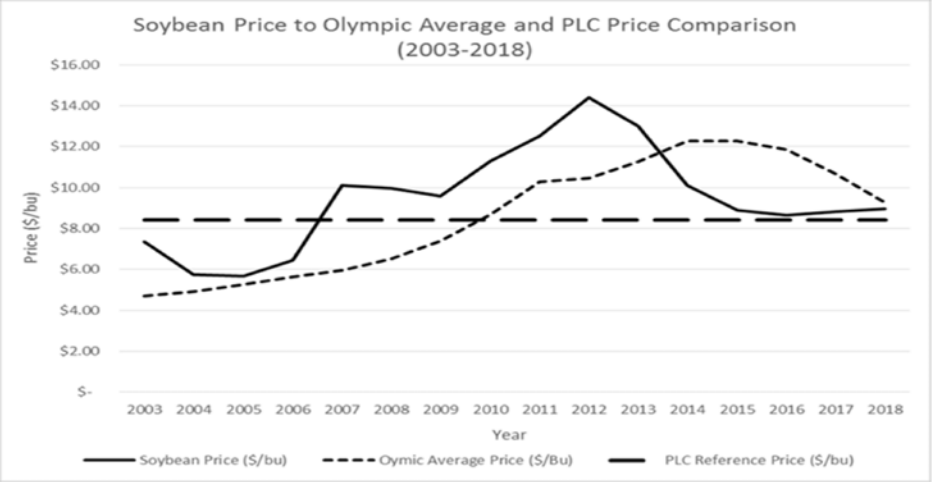

Figure 3. 6 Soybeans Price Comparison (2003-2018) (source: USDA)

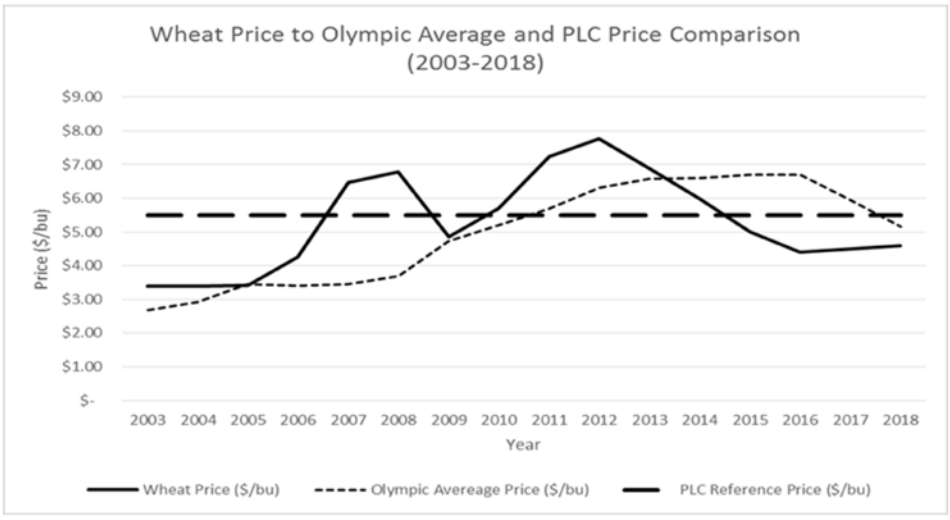

Figure 3. 7 Wheat Price Comparison (2003-2018) (source: USDA)

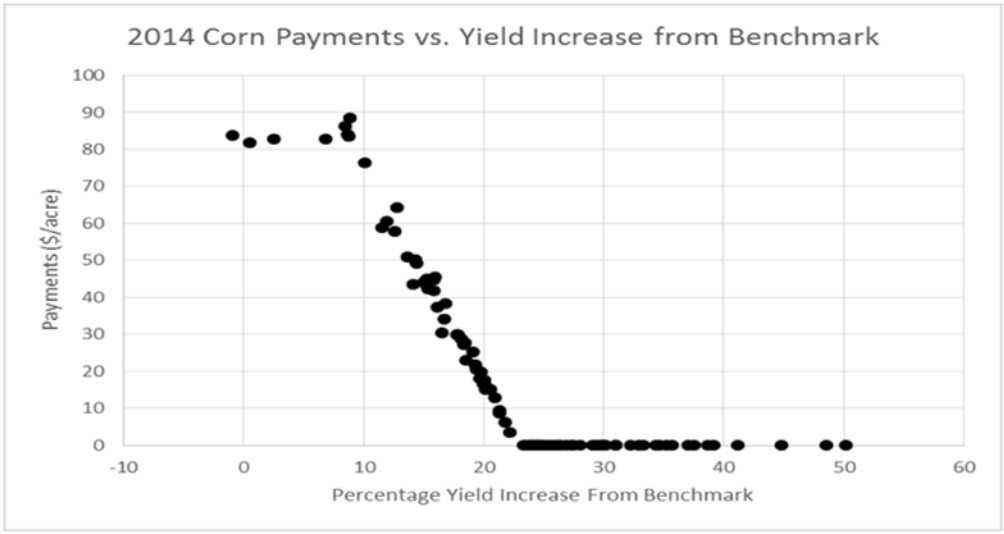

Figure 3. 8 2014 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

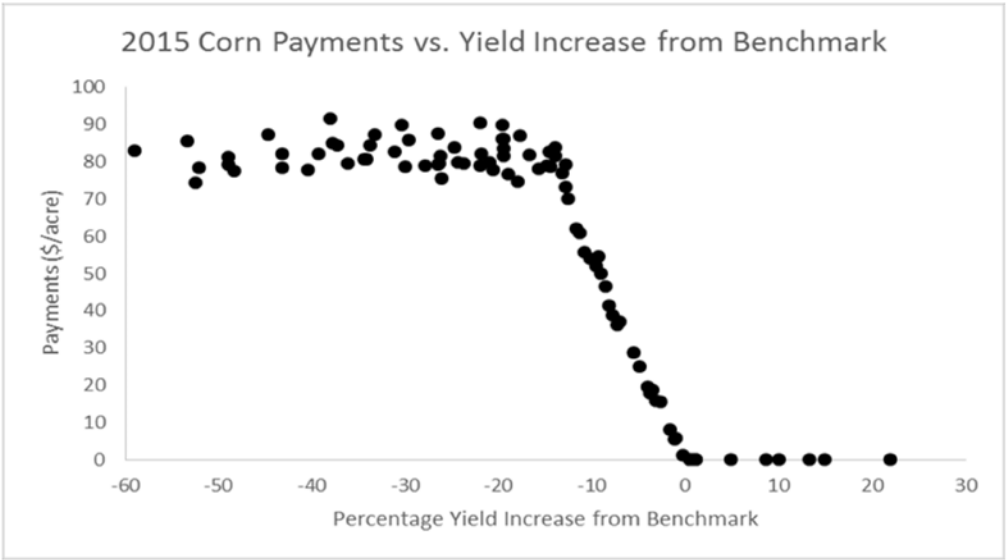

Figure 3. 9 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

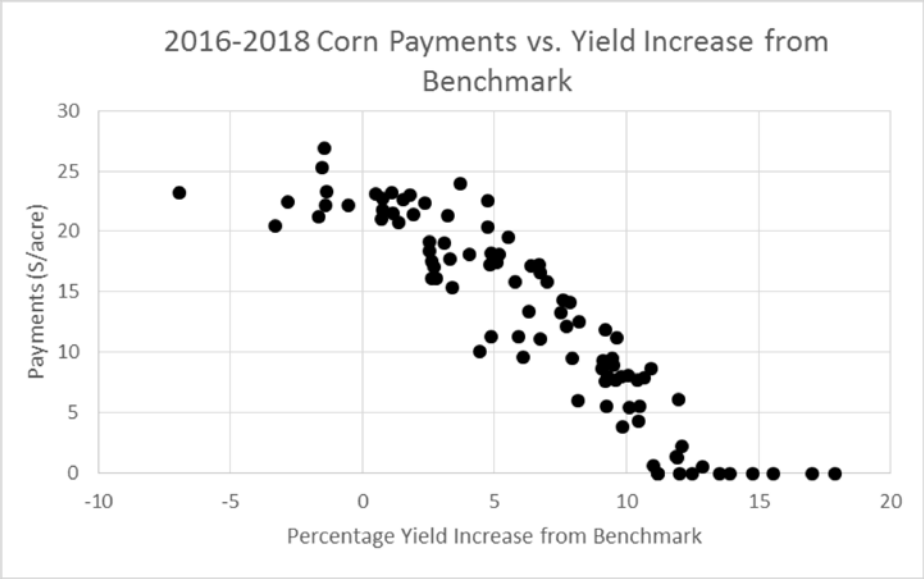

Figure 3. 10 2016-2018 Corn Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

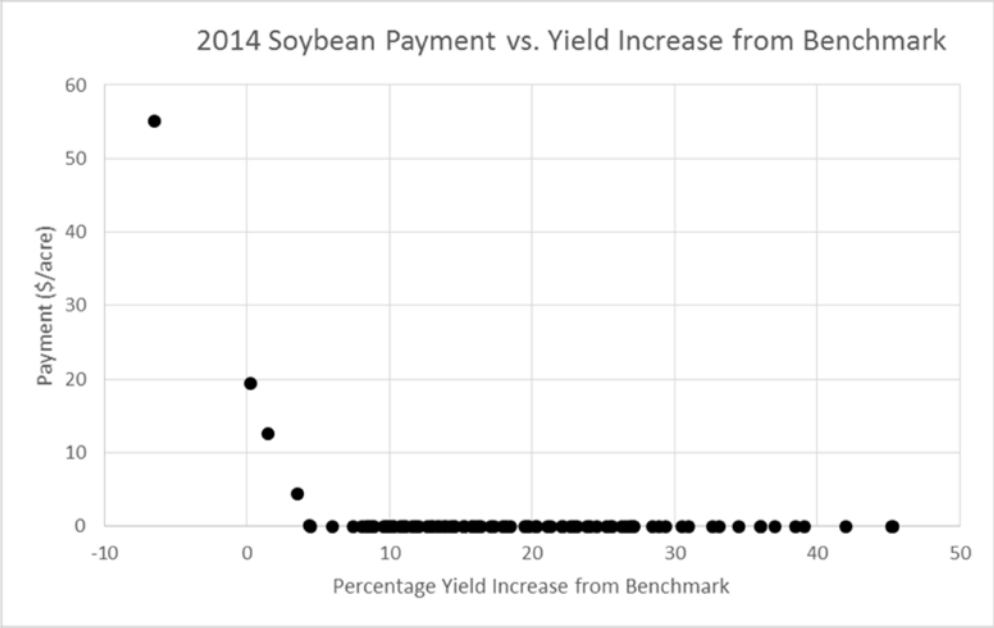

Figure 4. 5 2014 Soybean Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

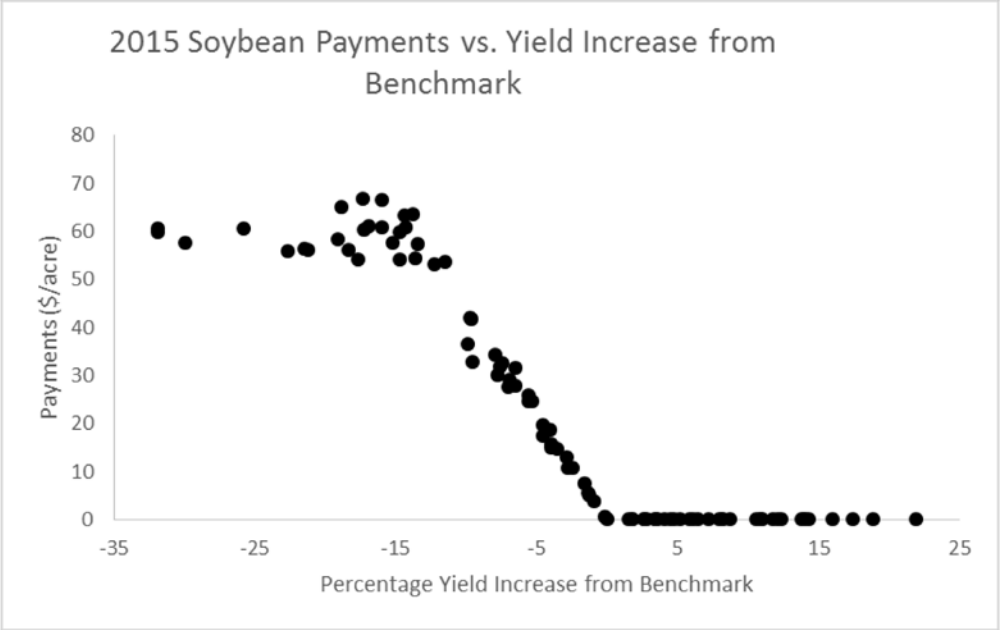

Figure 4. 7 2015 Soybean Payments versus Percentage Yield Increase from Y*ARC (source: author's calculations)

Regional Program Payments across Crops and Programs for 2014 to 2018 ($/acre)

Regional Payments Across Programs and Crops

Crop	Region	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Corn	NW	67	76	17	160	36	141
	NC	47	78	25	150	35	139
	NE	22	68	17	107	34	133
	MW	15	71	30	116	36	144
	MC	13	71	25	110	35	140
	ME	39	69	19	128	34	136
	SW	14	56	52	122	34	136
	SC	1	10	56	67	30	118
	SE	0	16	56	71	30	120
	State	26	65	29	120	34	137
Soybeans	NW	2	26	16	44	0	66
	NC	0	46	13	59	0	68
	NE	0	37	17	54	0	67
	MW	0	24	19	43	0	68
	MC	0	36	11	47	0	70
	ME	4	33	13	51	0	68
	SW	0	8	31	40	0	62
	SC	0	5	41	46	0	55
	SE	0	17	30	47	0	58
	State	1	28	18	47	0	66
Wheat	NW	0	35	35	70	196	112
	NC	0	31	37	69	194	111
	NE	0	34	38	72	194	111
	MW	0	6	55	61	175	100
	MC	0	13	54	68	197	113
	ME	0	18	44	61	189	108
	SW	0	11	43	54	174	100
	SC	0	4	55	59	158	90
	SE	0	19	54	73	175	100
	State	0	19	44	63	184	105

Tables for county payments results for all programs, years, and crops

NW Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Benton	28	81	32	141	38	150
Jasper	84	78	22	183	35	140
La Porte	31	34	58	122	29	114
Lake	83	74	23	180	35	137
Newton	88	81	0	169	38	149
Porter	86	81	33	201	36	143
Pulaski	82	75	0	157	34	136
Starke	59	70	0	129	31	123
White	64	82	0	146	38	151

NW Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Benton	0	0	17	17	0	70
Jasper	0	54	12	67	0	67
La Porte	19	0	9	28	0	63
Lake	0	30	18	48	0	63
Newton	0	31	10	41	0	67
Porter	0	0	37	37	0	66
Pulaski	0	28	15	43	0	56
Starke	13	5	27	44	0	58
White	0	51	6	57	0	71

NW Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Benton	0	41	25	66	211	120
Jasper	0	43	39	81	206	118
La Porte	0	10	36	45	183	105
Lake	0	41	37	77	191	109
Newton	0	41	38	79	201	114
Porter	0	34	28	62	190	109
Pulaski	0	42	35	77	203	116
Starke	0	39	36	75	189	108
White	0	31	37	68	198	113

NC Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Carroll	18	85	38	141	38	150
Cass	0	78	36	113	34	135
Elkhart	18	75	47	140	34	133
Fulton	76	80	15	171	36	141
Kosciusko	84	78	46	208	35	140
Marshall	45	78	20	144	35	139
Miami	42	74	15	131	34	134
St. Joseph	83	74	16	174	35	137
Wabash	50	76	2	128	35	139

NC Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Carroll	0	63	10	73	0	78
Cass	0	57	22	79	0	70
Elkhart	0	19	20	38	0	66
Fulton	0	51	9	60	0	63
Kosciusko	0	23	22	45	0	66
Marshall	0	50	13	63	0	65
Miami	0	54	8	62	0	68
St. Joseph	4	51	10	66	0	65
Wabash	0	39	4	43	0	66

NC Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Carroll	0	0	50	50	202	115
Cass	0	41	37	79	191	109
Elkhart	0	39	39	79	180	103
Fulton	0	39	35	74	184	105
Kosciusko	0	40	36	76	194	111
Marshall	0	39	22	61	189	108
Miami	0	40	34	74	197	112
St. Joseph	0	0	45	45	189	108
Wabash	0	41	37	78	200	114

NE Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Adams	15	74	0	89	34	133
Allen	9	73	0	82	34	134
Decatur	0	74	30	104	34	135
Huntington	42	77	0	119	35	140
Lagrange	61	73	21	155	33	131
Noble	23	35	60	118	31	125
Steuben	4	15	59	78	29	115
Wells	30	77	0	107	36	141
Whitley	0	71	30	101	32	125

NE Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Adams	0	56	29	85	0	69
Allen	0	53	5	58	0	68
Decatur	0	0	32	32	0	69
Huntington	0	55	8	63	0	69
Lagrange	0	12	31	44	0	67
Noble	0	0	20	20	0	60
Steuben	0	0	13	13	0	58
Wells	0	57	5	62	0	72
Whitley	0	53	14	67	0	67

NE Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Adams	0	38	34	73	188	107
Allen	0	42	38	80	202	115
Decatur	0	0	55	55	185	106
Huntington	0	39	36	75	191	109
Lagrange	0	28	39	67	203	116
Noble	0	25	35	59	182	104
Steuben	0	25	36	62	195	111
Wells	0	40	35	75	193	110
Whitley	0	39	35	74	190	108

MW Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clay	0	47	35	83	33	132
Fountain	20	81	21	122	38	150
Montgomery	45	85	38	168	39	155
Owen	0	0	47	47	30	120
Parke	27	77	25	129	36	141
Putnam	0	77	25	102	35	139
Tippecanoe	15	82	3	101	38	150
Vermillion	0	79	32	112	36	143
Vigo	0	49	48	97	33	129
Warren	0	75	46	121	37	148

MW Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clay	0	0	59	59	0	60
Fountain	0	23	57	80	0	69
Montgomery	0	60	45	105	0	76
Owen	0	10	83	93	0	54
Parke	0	4	63	67	0	62
Putnam	0	0	71	71	0	67
Tippecanoe	0	57	39	95	0	71
Vermillion	0	18	84	102	0	67
Vigo	0	14	75	89	0	60
Warren	0	0	53	53	0	73

MW Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clay	0	33	30	63	154	88
Fountain	0	0	45	45	180	103
Montgomery	0	0	82	82	184	105
Owen	0	0	54	54	153	87
Parke	0	0	85	85	167	95
Putnam	0	0	52	52	175	100
Tippecanoe	0	18	38	56	201	115
Vermillion	0	0	69	69	168	96
Vigo	0	4	29	34	154	88
Warren	0	0	69	69	183	104

MC Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Bartholomew	0	27	61	88	31	124
Boone	9	80	15	104	37	145
Clinton	25	86	1	113	40	157
Dearborn	0	0	57	57	28	111
Grant	30	76	10	116	35	138
Hamilton	0	75	0	75	35	137
Hancock	21	75	21	117	35	138
Hendricks	0	75	16	91	35	138
Howard	45	83	21	149	38	151
Johnson	0	53	43	95	31	122
Madison	22	80	4	105	36	144
Marion	49	72	48	170	34	137
Morgan	0	59	43	102	32	126
Rush	0	77	57	134	35	139
Shelby	0	51	46	97	32	126
Tipton	13	85	25	123	39	156

MC Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Bartholomew	0	0	39	39	0	60
Boone	0	58	0	58	0	73
Clinton	0	60	13	72	0	76
Dearborn	0	0	39	39	0	54
Grant	0	57	0	57	0	72
Hamilton	0	57	0	57	0	74
Hancock	0	40	4	44	0	67
Hendricks	0	10	8	18	0	66
Howard	0	61	11	72	0	77
Johnson	0	0	27	27	0	62
Madison	0	57	3	60	0	72
Marion	0	0	34	34	0	60
Morgan	0	0	19	19	0	60
Rush	0	7	14	21	0	71
Shelby	0	0	19	19	0	66
Tipton	0	63	13	76	0	79

MC Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Bartholomew	0	0	97	97	199	114
Boone	0	0	58	58	199	114
Clinton	0	43	38	81	208	119
Dearborn	0	0	72	72	152	87
Grant	0	41	35	76	198	113
Hamilton	0	0	50	50	196	112
Hancock	0	0	39	39	196	112
Hendricks	0	0	55	55	197	113
Howard	0	36	39	75	204	116
Johnson	0	38	38	76	194	111
Madison	0	6	34	41	183	105
Marion	0	42	42	84	196	112
Morgan	0	21	45	66	183	104
Rush	0	9	40	49	204	116
Shelby	0	0	76	76	193	110
Tipton	0	17	47	64	214	122

ME Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Blackford	84	74	0	158	35	139
Delaware	44	75	20	139	33	132
Fayette	0	0	62	62	33	133
Henry	29	78	23	129	36	143
Jay	51	73	6	130	33	130
Randolph	50	75	12	136	35	138
Union	38	82	30	150	38	150
Wayne	6	66	26	98	34	133

ME Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Blackford	55	53	1	109	0	69
Delaware	0	54	15	70	0	69
Fayette	0	0	15	15	0	68
Henry	0	24	14	38	0	71
Jay	0	53	12	65	0	67
Randolph	0	32	13	46	0	66
Union	0	30	4	34	0	74
Wayne	0	0	21	21	0	65

ME Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Blackford	0	42	38	80	199	113
Delaware	0	31	37	68	200	114
Fayette	0	0	53	53	197	112
Henry	0	22	40	62	206	117
Jay	0	0	53	53	178	102
Randolph	0	26	36	61	185	106
Union	0	0	47	47	169	97
Wayne	0	42	38	80	202	116

SW Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Dubois	18	77	52	147	35	139
Gibson	0	52	64	115	35	139
Greene	0	1	60	62	30	120
Knox	16	79	42	137	36	141
Martin	0	71	24	94	33	130
Pike	58	74	60	192	33	133
Posey	0	15	72	87	35	139
Spencer	37	44	48	130	33	131
Sullivan	0	75	30	104	35	137
Vanderburgh	17	69	54	140	35	137
Warrick	34	72	42	149	33	132

SW Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Dubois	0	0	59	59	0	62
Gibson	0	0	40	40	0	61
Greene	0	1	25	26	0	60
Knox	0	27	3	31	0	64
Martin	0	0	26	26	0	61
Pike	0	0	29	29	0	59
Posey	0	0	50	50	0	61
Spencer	0	0	38	38	0	61
Sullivan	0	26	19	45	0	63
Vanderburgh	0	0	41	41	0	62
Warrick	0	5	46	52	0	61

SW Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Dubois	0	21	32	52	165	94
Gibson	0	13	42	55	190	109
Greene	0	0	55	55	149	85
Knox	0	23	31	54	159	91
Martin	0	35	31	65	158	90
Pike	0	14	41	55	149	85
Posey	0	9	45	54	186	106
Spencer	0	0	52	52	160	91
Sullivan	0	0	68	68	149	85
Vanderburgh	1	0	49	50	188	107
Warrick	0	0	51	51	161	92

SC Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Brown	0	0	62	62	26	102
Crawford	0	18	41	59	30	117
Floyd	43	0	27	70	29	117
Harrison	0	0	60	60	30	118
Jackson	0	17	51	68	29	116
Lawrence	0	0	62	62	31	123
Monroe	0	58	62	120	31	122
Orange	0	0	68	68	33	133
Perry	0	39	46	85	31	121
Washington	0	0	57	57	29	115

SC Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Brown	0	0	42	42	0	55
Crawford	0	0	49	49	0	52
Floyd	0	31	32	63	0	50
Harrison	0	0	72	72	0	51
Jackson	0	15	27	41	0	59
Lawrence	0	0	45	45	0	53
Monroe	0	0	34	34	0	54
Orange	0	0	58	58	0	60
Perry	0	0	35	35	0	55
Washington	0	0	37	37	0	52

SC Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Brown	0	0	73	73	138	79
Crawford	0	0	73	73	138	79
Floyd	0	0	73	73	138	79
Harrison	0	0	32	32	168	96
Jackson	0	0	77	77	169	97
Lawrence	0	0	49	49	139	79
Monroe	0	0	73	73	138	79
Orange	0	2	71	74	142	81
Perry	0	0	35	35	138	79
Washington	0	26	30	56	158	90

SE Region payments for corn

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clark	0	5	58	64	30	119
De Kalb	0	37	59	96	29	116
Franklin	0	6	51	57	34	136
Jefferson	0	8	49	57	29	114
Jennings	0	0	56	56	30	118
Ohio	0	0	55	55	27	107
Ripley	0	24	56	80	30	120
Scott	0	18	62	79	31	124
Switzerland	0	0	47	47	29	116

SE Region payments for Soybeans

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clark	0	16	53	70	0	53
De Kalb	0	14	14	28	0	58
Franklin	0	0	23	23	0	67
Jefferson	0	34	40	74	0	52
Jennings	0	0	37	37	0	57
Ohio	0	0	27	27	0	54
Ripley	0	26	28	55	0	58
Scott	0	51	28	79	0	62
Switzerland	0	0	37	37	0	57

SE Region payments for wheat

Counties	ARC 2014	ARC 2015	ARC 2016-18	ARC 2014-18	PLC 2014-18	DP 2014-18
Clark	0	0	70	70	156	89
De Kalb	0	43	39	81	203	116
Franklin	0	27	31	58	161	92
Jefferson	0	0	71	71	153	87
Jennings	0	0	78	78	164	94
Ohio	0	0	72	72	152	87
Ripley	0	0	61	61	147	84
Scott	0	0	69	69	159	91
Switzerland	0	0	72	72	152	87